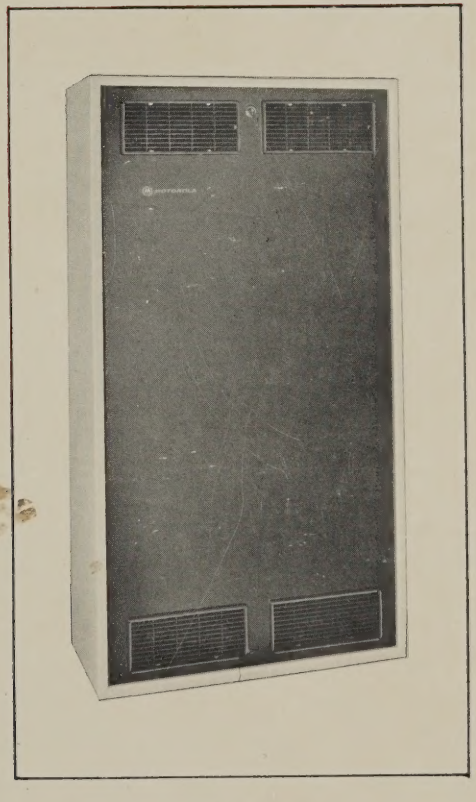
MOTOROLA

"MICOR"®

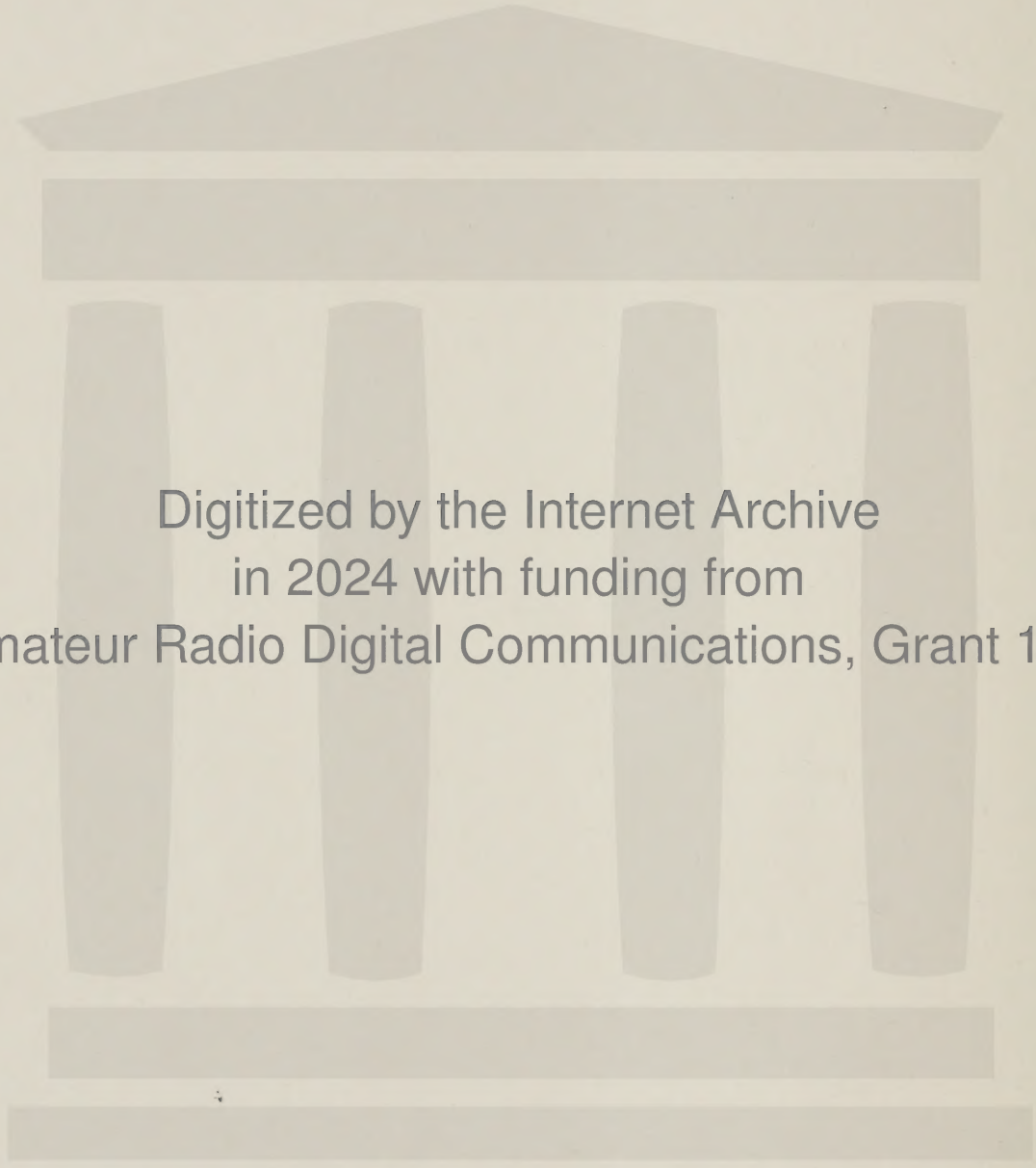
Base and Repeater Stations

851-866 MHz Transmit
806-821 MHz Receive

68P81031E45-B



This Manual Must be Used With Control and Applications Manual 68P81025E60



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USER QUESTIONNAIRE

To the User of This Instruction Manual:

Motorola is engaged in a continuous program of improving its instruction literature. We believe that you can aid us in this program, so that we in turn can better help you service our equipment. To foster these aims, would you please answer the following questions:

First Fold

SCHEMATIC DIAGRAMS AND CABLING DIAGRAMS

First Fold

1. ☐ Are accurate and easy to follow
2. ☐ Contain minor errors
3. ☐ Contain major errors
4. ☐ Are difficult to follow

If you have checked any box except 1, please tell us what schematic diagrams, or portions thereof, were at fault, or enter other comments.*

_____

_____

68P85901D80—J

TEXT

1. ☐ Easy to follow – helps to service equipment
2. ☐ Would like more information on*

Second Fold

_____ Second Fold

_____

3. ☐ Some instruction sections are too long or superfluous such as*

_____

_____

4. ☐ Other comments*

_____

_____

_____

(continued on reverse side)

PARTS LIST

1. ☐ Are complete and accurate
2. ☐ Would like more information as follows*

_____

_____

ILLUSTRATIONS IN GENERAL

1. ☐ Are complete and accurate
2. ☐ Want more illustrations such as*

_____

_____

3. ☐ Some are superfluous such as*

_____

_____

The name of my instruction manual is:

_____

The part number of my instruction manual is:

_____

(This number will be found on the cover or on the title page)

My name is _____

Company _____

Address _____

City _____ **State** _____ **Zip** _____

Date _____

Phone No. (include area code)_____

***Whenever possible, give complete model No. of equipment, and part No. of diagram or part No. of instruction section. This information is important.**

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Schaumburg, Illinois 60196

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3/30/78-NPC

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PERFORMANCE SPECIFICATIONS

GENERAL

Frequency range: 806-866 MHz
No. of Frequencies: Up to 2 frequencies

MODEL SERIES	CONTINOUS MINIMUM RF POWER OUTPUT	MAXIMUM FINAL INPUT POWER	POWER INPUT REQUIREMENTS	
			STANDBY 121 V, 60 Hz	TRANSMIT 121 V, 60 Hz
C75RCB	60 watts	450 watts	2.6 amps	7.6 amps

CABINET	DIMENSION (INCHES)	APPROX. SHIPPING WEIGHT (LBS.)
60-Inch Indoor	22 W x 60 H x 20 D	220
75-Inch Outdoor	23-3/4 W x 75-5/8 H x 25-1/4 D	365

Metering:

An optional, internally mounted meter, a single scale, 0-50 microammeter with 2,000 ohms equivalent series resistance, or a Motorola portable test set can be used to measure all circuits essential to tuning and checking.

TRANSMITTER

RF POWER OUTPUT	60-125 watts (variable)
OUTPUT IMPEDANCE	50 ohms
OSCILLATOR FREQUENCY STABILITY	Channel element maintains oscillator frequency within ±0.0001% from -30°C to +60°C ambient (+25°C reference)
TRANSMITTER SIDE BAND NOISE	70 @ ±25 kHz 85 @ ±1 MHz
SPURIOUS & HARMONICS (CONDUCTED)	More than 85 dB below carrier
MODULATION	15F2 and 16F3: ±5 kHz for 100% at 1000 Hz
AUDIO SENSITIVITY	Local: 0.120 volt ±3 dB for 60% maximum deviation at 1000 Hz. Remote Telephone Line: -20 dBm max. for 60% maximum deviation at 1000 Hz
FM NOISE	55 dB below 60% system deviation at 1000 Hz
AUDIO RESPONSE	+1, -3 dB from 6 dB/octave pre-emphasis, 300-3000 Hz, referenced to 1000 Hz
AUDIO DISTORTION	Less than 2% at 1000 Hz; 60% system deviation

PERFORMANCE SPECIFICATIONS (cont'd.)

"SENSITRON" RECEIVER

CHANNEL SPACING		25 kHz
EIA MODULATION ACCEPTANCE		±8 kHz minimum
FREQUENCY		Channel element maintains receiver frequency within ±0.0002% of reference frequency from -30°C to +60°C ambient temperature (+25°C reference).
INPUT IMPEDANCE		50 ohms
SENSITIVITY	20 dB QUIETING	0.5 uV
	EIA SINAD	0.35 uV
SELECTIVITY (EIA SINAD)		-80 dB @ ±25 kHz
EIA SINAD INTERMODULATION		-75 dB
SPURIOUS AND IMAGE REJECTION		100 dB minimum
SQUELCH SENSITIVITY CARRIER SQUELCH (adjustable)		.25 uV or less at threshold
TONE-CODED SQUELCH		.25 uV or less
DIGITAL-CODED SQUELCH		.25 uV or less
AUDIO (TELEPHONE LINE)	OUTPUT	+18 dBm at 600 ohms
	RESPONSE	+1, -3 dB
	DISTORTION	3% at 1000 Hz
	HUM & NOISE	-55 dB
	LOCAL SPEAKER	10 watts at 8 ohms output available

FCC LICENSE DESIGNATION

MODEL	FCC DESIGNATION
C75 Series Transmitter	CC5011
Non-shifted I-F Receiver	RC0135

EPS-21202-O

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SAFETY INFORMATION

The United States Department of Labor, through the provisions of the Occupational Safety and Health Act of 1970 (OSHA), has established an electromagnetic radiation safety standard which applies to this equipment. Normal use of this radio will result in exposures far below the OSHA limit. However, the following precautions are recommended:

DO NOT approach the antenna closer than four inches for omni–directional antennas or four feet for all other antennas when the transmitter is operative.

DO NOT operate the transmitter unless all rf connectors are secure and any open connectors are properly terminated with a leakproof load.

NEPS–21233–O

FOREWORD

1. SCOPE OF MANUAL

This manual is intended for use by experienced technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. Changes which occur after the printing date are incorporated by Instruction Manual Revisions (SMR). These SMR's are added to the manuals as the engineering changes are incorporated into the equipment.

2. MODEL AND KIT IDENTIFICATION

Motorola equipments are specifically identified by an overall model number on the nameplate. In most cases, assemblies and kits which make up the equipment also have kit model numbers stamped on them. When a production or engineering change is incorporated, revision suffix numerals are added to the affected kit model number. For example, a TLN4448A becomes a TLN4448A-1 with the first revision, TLN4448A-2 with the second revision, etc.

As diagrams are updated, information about the change is incorporated into a revision column. This revision column appears in the manual next to the parts list or, in some cases, on the diagram. It lists the reference number, part number, and description of the parts removed or replaced when the suffix number changed. With this information, the technician can find the information for the current version, and any previous version, of the equipment covered by the manual.

3. SERVICE

Motorola's National Service Organization offers one of the finest nation-wide installation and maintenance programs available to communication equipment users. This organization includes approximately 800 authorized Motorola Service Stations (MSS) located throughout the United States, each manned by one or more trained, FCC licensed technicians.

These MSS's are independently owned and operated and were selected by Motorola to service its customers. Motorola maintenance is available on either a time and material basis or on a periodic fixed-fee type arrangement.

The administrative staff of this organization consists of national, area and district service managers and district representatives, all of whom are Motorola employees with the objective to improve the service to our customers.

Should you wish to purchase a service contract for your Motorola equipment, contact your Motorola Service Representative, or write to:

National Service Manager
Motorola Communications Division
1303 E. Algonquin Road
Schaumburg, Illinois 60196

4. REPLACEMENT PARTS ORDERING

Motorola maintains a number of parts offices strategically-located throughout the United States. These facilities are staffed to process parts orders, identify part numbers, and otherwise assist in the maintenance and repair of Motorola Communications Division products.

Orders for all parts *except* crystals, active filters, code plugs, channel elements, and "Vibrasender" ® and "Vibrasponder" ® resonant reeds should be sent to the nearest area parts center. Orders for instruction manuals should also be sent to the area parts center.

When ordering replacement parts or equipment information, the complete identification number should be included. This applies to all components, kits, and chassis. If the component part number is not known, the order should include the number of the chassis or kit of which it is a part, and sufficient description of the desired component to identify it.

Orders for crystals, channel elements, active filters, code plugs, and reeds should be sent directly to the factory address listed on the following page. Crystal and channel element orders should specify the crystal or channel element type number, crystal and carrier frequency, and the chassis model number in which the part is used.

Orders for active filters, code plugs, "Vibrasender" and "Vibrasponder" resonant reeds should specify type number and frequency, and should identify the owner/operator of the communications system in which these items are to be used.

5. ADDRESSES

5.1 GENERAL OFFICES

MOTOROLA Communications and Electronics Inc.
Communications and Electronics Parts
1313 E. Algonquin Rd.,
Schaumburg, Illinois 60196
Phone: 312-576-3900

5.2 U.S. ORDERS

WESTERN AREA PARTS
1170 Chess Drive, Foster City,
San Mateo, California 94404
Phone: 415-349-3111
TWX: 910-375-3877

MIDWEST AREA PARTS
1313 E. Algonquin Road
Schaumburg, Ill. 60196
Phone: 312-576-7322
TWX: 910-693-0869

MID-ATLANTIC AREA PARTS
7230 Parkway Drive
Hanover, Maryland 20176
Phone: 301-796-8600
TWX: 710-862-1941

EAST CENTRAL AREA PARTS
12995 Snow Road,
Parma, Ohio 44130
Phone: 216-267-2210
TWX: 810-421-8845

EASTERN AREA PARTS
85 Harristown Road,
Glen Rock, New Jersey 07452
Phone: 201-447-4000
TWX: 710-988-5602

PACIFIC SOUTHWESTERN AREA PARTS
P.O. Box 85036
San Diego, California 92138
Phone: 714-578-2222
TWX: 910-335-1634

GULF STATES AREA PARTS
8550 Katy Freeway
Suite 128
Houston, Texas 77024
Phone: 713-932-8955

SOUTHWESTERN AREA PARTS
P.O. Box 34290
3320 Belt Line Road,
Dallas, Texas 75234
Phone: 214-241-2151
TWX: 910-860-5505

SOUTHEASTERN AREA PARTS
P.O. Box 368
Decatur, Georgia 30031
Phone: 504-981-9800
TWX: 810-766-0876

5.3 CANADIAN ORDERS

CANADIAN MOTOROLA ELECTRONICS COMPANY
National Parts Department
3125 Steeles Avenue,
East Willowdale, Ontario
Phone: 416-499-1441
TWX: 610-492-2713
Telex: 02-29944LD

5.4 ALL COUNTRIES EXCEPT U.S. AND CANADA

MOTOROLA, INC. OR MOTOROLA AMERICAS, INC.
International Parts Dept.
1313 E. Algonquin Road
Schaumburg, Illinois 60196 U.S.A.
Phone: 312-576-6492
TWX: 910-693-0869
Telex: 722443 or 722424
Cable: MOTOL PARTS

5.5 FACTORY ADDRESS FOR CRYSTAL, CHANNEL ELEMENT, ACTIVE FILTER, CODE PLUGS AND RESONANT REED ORDERS

ALL MAIL ORDERS
Motorola, Inc.
Component Products Sales & Service
P.O. Box 66191
O'Hare International Airport
Chicago, Ill. 60666

CORRESPONDENCE
Motorola, Inc.
Component Products Sales & Service
2553 N. Edgington Street
Franklin Park, Illinois 60131

TLN1248A	C2-R2 TONE CONTROL MODULE
TLN4665A	F2 TONE CONTROL MODULE
TLN4636A	TIME-OUT TIMER
TLN4662A	SQUELCH GATE MODULE
TLN4638A	F1-"PL" TONE CONTROL MODULE
TLN8799A	SERVICE BOARD
TRF1011C	RECEIVER RF & IF BOARD
TRN8406A	RECEIVER AUDIO & SQUELCH BOARD
TRN4290B	RECEIVER AUDIO POWER AMPLIFIER
TRN6002A	TONE "PRIVATE-LINE" DECODER
TLN8381A	"VIBRASPONDER" RESONANT REED
TLN5729A	"DIGITAL PRIVATE-LINE" DECODER
TLN5654A	"PL" DECODER HARDWARE KIT
KXN1029A	RECEIVER CHANNEL ELEMENT
TRN6589A	2ND RECEIVER COUPLER
TPN1147A	HIGH VOLTAGE POWER SUPPLY
TPN1148A	LOW VOLTAGE POWER SUPPLY
TKN6837A	DC CABLE KIT
TKN6834A	STATION CABLE KIT
TRN6587A	POWER JUNCTION BOX
TLN5703A	TRANSFORMER KIT
TRN6672A	HARDWARE KIT
THN6304A	CABINET (60-INCH)
TRN6673A	2ND RECEIVER HARDWARE KIT
TRN6729A	BLOWER ASSEMBLY (60")
TRN6192A	TRANSMIT SHIELD KIT
TLN5891A	RECEIVER SHIELD KIT
TRN6573A	OSCILLATOR MOUNTING KIT
TLN1246A	RECEIVER FILTER
TLN1746A	RECEIVER FILTER
TRN6006A	RECEIVER AUDIO & SQUELCH BOARD

EPS-26120-O

MOTOROLA

STATION MODEL CHART

FOR

"MICOR" "COMPA-STATION" AND UPRIGHT STATIONS

851-866 MHz TRANSMIT
806-821 MHz RECEIVER

CODE:

[X] = ONE SUPPLIED

[2] = NUMBER INDICATES QUANTITY SUPPLIED

C75RCB1105B

B = BASE STATION
BT = REPEATER STATION

5 = DC CONTROL
6 = TONE CONTROL

0 = T1-R1
2 = T2-R2
4 = T2-2R1

1 = CARRIER SQUELCH
3 = "PRIVATE-LINE" TONE CODED SQUELCH
6 = "DIGITAL PRIVATE-LINE" CODED SQUELCH

| STATION MODEL | DESCRIPTION | | | KIT | UNIFIED CONTROL CHASSIS | UNIFIED CONTROL CHASSIS | ANTENNA RELAY | EXCITER & BANDPASS FILTER | TRIPLER & DOUBLER | INTERMEDIATE POWER AMPLIFIER (15 W) | POWER AMPLIFIER (125 W) | DIRECTIONAL COUPLER | POWER CONTROL BOARD | TRANSMITTER CHANNEL ELEMENT | TRANSMIT INHIBIT KIT | TONE "PRIVATE-LINE" ENCODER | TONE "PRIVATE-LINE" ENCODER (SIMPLEX) | "DIGITAL PRIVATE-LINE" ENCODER (DUPLEX) | "DIGITAL PRIVATE-LINE" ENCODER CODE PLUG | "VIBRASENDER" RESONANT REED | "PL" ENCODER HARDWARE KIT | STATION CONTROL MODULE | LINE DRIVER (2-WIRE, 2-RECEIVER) | LINE DRIVER (2-WIRE, 1-RECEIVER) | DC TRANSFER MODULE (T1) | DC TRANSFER MODULE (C2-R2) | DC TRANSFER MODULE (F1-"PL") | DC TRANSFER MODULE (F2-R2 MUTE) | GUARD TONE DECODER | F1 TONE CONTROL MODULE | C2-R2 TONE CONTROL MODULE | F2 TONE CONTROL MODULE | TIME-OUT TIMER | SQUELCH GATE MODULE | F1-"PL" TONE CONTROL MODULE | SERVICE BOARD | RECEIVER RF & IF BOARD | RECEIVER AUDIO & SQUELCH BOARD | RECEIVER AUDIO POWER AMPLIFIER | TONE "PRIVATE-LINE" DECODER | "VIBRASPONDER" RESONANT REED | "DIGITAL PRIVATE-LINE" DECODER | "PL" DECODER HARDWARE KIT | RECEIVER CHANNEL ELEMENT | 2ND RECEIVER COUPLER | HIGH VOLTAGE POWER SUPPLY | LOW VOLTAGE POWER SUPPLY | DC CABLE KIT | STATION CABLE KIT | POWER JUNCTION BOX | TRANSFORMER KIT | HARDWARE KIT | CABINET (60-INCH) | 2ND RECEIVER HARDWARE KIT | BLOWER ASSEMBLY (60") | TRANSMIT SHIELD KIT | RECEIVER SHIELD KIT | OSCILLATOR MOUNTING KIT | RECEIVER FILTER | TRANSMIT FILTER | RECEIVER AUDIO & SQUELCH BOARD |
|---|---|---

TLN8799A	SERVICE BOARD
TPF1011B	RECEIVER RF & IF BOARD
TRN6752A	RECEIVER AUDIO & SQUELCH BOARD
TLN4220B	RECEIVER AUDIO POWER AMPLIFIER
TRN6002A	TONE "PRIVATE-LINE" DECODER
TLN8351A	"VIBRASPONDER" RESONANT REED
TLN5729A	"DIGITAL PRIVATE-LINE" DECODER
TLN5654A	"PL" DECODER HARDWARE KIT
KXN1029A	RECEIVER CHANNEL ELEMENT
TKN6802A	CABLE KIT (RCVR TO ANT.)
TRN6589A	2ND RECEIVER COUPLER
TLN1738A	2ND RECEIVER CHASSIS
TPN1147A	HIGH VOLTAGE POWER SUPPLY
TPN1148A	LOW VOLTAGE POWER SUPPLY
TKN6837A	DC CABLE KIT
TKN6834A	STATION CABLE KIT
TRN6587A	POWER JUNCTION BOX
TLN5703A	TRANSFORMER KIT
TRN6672A	HARDWARE KIT
THN6304A	CABINET (60-INCH)
TRN6673A	2ND RECEIVER HARDWARE KIT
TRN6729A	BLOWER ASSEMBLY (60")
TRN6192A	TRANSMIT SHIELD KIT
TLN5891A	RECEIVER SHIELD KIT
TRN6573A	OSCILLATOR MOUNTING KIT

EPS-21203-A

FACTORY INSTALLED OPTIONS

OPTION PLAN NUMBER OR OPTIONAL KIT NUMBER	DESCRIPTION	PUBLICATION REFERENCE	
		APPLICABLE SECTION WITHIN THIS MANUAL	PART NUMBER OF SEPARATE PUBLICATION
DC REMOTE CONTROL STATION OPTIONS			
C63	TLN4637A Paging Module	None	68P81025E60
C143	TLN4664A Repeater Control Module	None	68P81025E60
TONE REMOTE CONTROL STATION OPTIONS			
C56 OR C63	TLN4667A F2-R2 Mute Control Module TLN1253A Paging Control Module	None None	68P81025E60 68P81025E60
TLN1249A OR TLN1250A OR TLN1251A	Squelch Control Module Repeater Control Module "PL" Control Module	None None None	68P81025E60 68P81025E60 68P81025E60
TLN1252A	"Wild Card" Module (See Note 3)	None	68P81025E60
TRN6326A	Digital "PL" 2-User Module (community rptr only)	None	None
C269	Spectra TAC Encoder	None	68P81107E40
OPTIONS APPLICABLE TO BOTH DC AND TONE REMOTE CONTROL STATIONS			
C31BV	Transmit Only Station (Delete Receiver) Carrier Squelch	None	None
C31BW	Transmit Only Station (Delete Receiver) "Private-Line" Squelch	None	None
C31BY	Transmit Only Station (Delete Receiver) "Digital Private-Line" Squelch	None	None
C140	AND Squelch Control	Receiver Interconnect Unit	None
C144 OR C144AB	TLN4668A 4-Wire Audio (1-Rcvr) TLN4668A 4-Wire Audio (2-Rcvr)	None None	68P81025E60 68P81025E60
TLN1181A	Single-Tone Decoder Module	None	68P81025E60
TLN4636A	Time-Out Timer Module	None	68P81025E60
C149	DC Metering W/Monitor Intercom	None	None
C226	Service Intercom W/Speaker	None	None
C36	75" Outdoor Cabinet ("Compa-Station")	68P81033E42	None
C75	Omit Time-Out Timer Module	None	None
TLN4151A	Relay Kit	None	68P81025E60
C84, 86	Omit Wire Line (rptr stations only)	None	None
TMN6071	Test Microphone	None	None
C501	Omit 1 Transmitter Channel Element	None	None
C502	Omit 2 Transmitter Channel Elements	None	None
C521	Omit 1 Receiver Channel Element	None	None
C522	Omit 2 Receiver Channel Elements	None	None
TLN4399A	AC Power Surge Supressor (120 V)	None	None
TLN4662A	Field Installed Squelch Gate Module	None	None
TDF6110	Duplexer	None	None
C27	46-Inch Outdoor Cabinet ("Compa-Station")	68P81033E46	None
U27	75-Inch Outdoor Cabinet (Upright Station)	68P81033E42	None

NOTES:

1. The options listed are not necessarily compatible with each other or with each type of station. Consult your Motorola representative for compatibility details.
2. Other options may become available after the printing of this instruction manual. Consult your Motorola representative for a complete listing of the current options available for your station.
3. One to four TLN4151A Relay Kits may be used with this option to provide one to four form "C" contact closures for operation of external equipment.
4. TLN1745A Service Intercom Kit is identical to TLN1740A DC Metering W/Monitor Intercom Kit but less dc metering feature.

MOTOROLA

STATION MODEL CHART

FOR

"MICOR" "COMPA-STATION" AND UPRIGHT STATIONS

851-866 MHz TRANSMIT
806-821 MHz RECEIVE

CODE

[X] = ONE SUPPLIED

[2] = NUMBER INDICATES QUANTITY SUPPLIED

C 7 5 R C B 1 1 0 5 A

- A = BASE STATION
- AT = REPEATER STATION
- 5 = DC CONTROL
- 6 = TONE CONTROL
- 0 = T1-R1
- 2 = T2-R2
- 4 = T2-2R1
- 1 = CARRIER SQUELCH
- 3 = "PRIVATE-LINE" TONE CODED SQUELCH
- 6 = "DIGITAL PRIVATE-LINE" CODED SQUELCH

STATION MODEL	DESCRIPTION		
	SQUELCH TYPE	CONTROL TYPE	OPERATING CHANNELS
	BASE STATIONS		
C75RCB1105A	CARRIER	DC	T1-R1
C75RCB1106A	CARRIER	TONE	T1-R1
C75RCB1125A	CARRIER	DC	T2-R2
C75RCB1126A	CARRIER	TONE	T2-R2
C75RCB1145A	CARRIER	DC	T2-2R1
C75RCB1146A	CARRIER	TONE	T2-2R1
C75RCB3105A	"PL" TONE-CODED	DC	T1-R1
C75RCB3106A	"PL" TONE-CODED	TONE	T1-R1
C75RCB3125A	"PL" TONE-CODED	DC	T2-R2
C75RCB3126A	"PL" TONE-CODED	TONE	T2-R2
C75RCB3145A	"PL" TONE-CODED	DC	T2-2R1
C75RCB3146A	"PL" TONE-CODED	TONE	T1-2R1
C75RCB6105A	"DIGITAL PRIVATE-LINE"	DC	T1-R1
C75RCB6106A	"DIGITAL PRIVATE-LINE"	TONE	T1-R1
C75RCB6125A	"DIGITAL PRIVATE-LINE"	DC	T2-R2
C75RCB6126A	"DIGITAL PRIVATE-LINE"	TONE	T2-R2
C75RCB6145A	"DIGITAL PRIVATE-LINE"	DC	T2-2R1
C75RCB6146A	"DIGITAL PRIVATE-LINE"	TONE	T2-2R1
	REPEATER (RT) STATIONS		
C75RCB1105AT	CARRIER	DC	T1-R1
C75RCB1106AT	CARRIER	TONE	T1-R1
C75RCB3105AT	"PL" TONE-CODED	DC	T1-R1
C75RCB3106AT	"PL" TONE-CODED	TONE	T1-R1
C75RCB6105AT	"DIGITAL PRIVATE-LINE"	DC	T1-R1
C75RCB6106AT	"DIGITAL PRIVATE-LINE"	TONE	T1-R1

KIT	DESCRIPTION
TCN1148A	UNIFIED CONTROL CHASSIS
TCN1187A	UNIFIED CONTROL CHASSIS
TRN6572A	ANTENNA RELAY
TLF1043A	EXCITER & BANDPASS FILTER
TLF1053A	TRIPLER & DOUBLER
TLF1069A	INTERMEDIATE POWER AMPLIFIER (15 W)
TLF1073A	POWER AMPLIFIER (125 W)
TLF6133A	DIRECTIONAL COUPLER
TRN6716A	POWER CONTROL BOARD
KXN1071A	TRANSMITTER CHANNEL ELEMENT
TRN6571A	TRANSMIT INHIBIT KIT
TLN5731A	TONE "PRIVATE-LINE" ENCODER
TTN6003A	"DIGITAL PRIVATE-LINE" ENCODER (SIMPLEX)
TLN5725A	"DIGITAL PRIVATE-LINE" ENCODER (DUPLEX)
TRN6004A	"DIGITAL PRIVATE-LINE" ENCODER CODE PLUG
RLN6210A	"VIBRASENDER" RESONANT REED
TRN6188A	"PL" ENCODER HARDWARE KIT
TLN4635B	STATION CONTROL MODULE
TLN4670B	LINE DRIVER (2-WIRE, 2-RECEIVER)
TLN4669B	LINE DRIVER (2-WIRE, 1-RECEIVER)
TLN4661A	DC TRANSFER MODULE (T1)
TLN4663A	DC TRANSFER MODULE (C2-R2)
TLN4659A	DC TRANSFER MODULE (F1-"PL")
TLN4660A	DC TRANSFER MODULE (F2-R2 MUTE)
TLN1245B	GUARD TONE DECODER
TLN4658A	F1 TONE CONTROL MODULE
TLN1248A	C2-R2 TONE CONTROL MODULE
TLN4665A	F2 TONE CONTROL MODULE
TLN4636A	TIME-OUT TIMER
TLN4662A	SQUELCH GATE MODULE
TLN4638A	F1-"PL" TONE CONTROL MODULE
TLN8739A	SERVICE BOARD
TRF1011B	RECEIVER RF & IF BOARD
TRN6752A	RECEIVER AUDIO & SQUELCH BOARD
TRN4290B	RECEIVER AUDIO POWER AMPLIFIER
TRN6002A	TONE "PRIVATE-LINE" DECODER
TLN8381A	"VIBRASPONDER" RESONANT REED
TLN5729A	"DIGITAL PRIVATE-LINE" DECODER
TLN5654A	"PL" DECODER HARDWARE KIT
KXN1029A	RECEIVER CHANNEL ELEMENT
TKN6802A	CABLE KIT (RCVR TO ANT.)
TRN6589A	2ND RECEIVER COUPLER
TLN1738A	2ND RECEIVER CHASSIS
TPN1147A	HIGH VOLTAGE POWER SUPPLY
TPN1148A	LOW VOLTAGE POWER SUPPLY
TKN6837A	DC CABLE KIT
TKN6834A	STATION CABLE KIT
TRN6587A	POWER JUNCTION BOX
TLN5703A	TRANSFORMER KIT
TRN6672A	HARDWARE KIT
TRN6304A	CABINET (60-INCH)
TRN6673A	2ND RECEIVER HARDWARE KIT
TRN6729A	BLOWER ASSEMBLY (60")
TRN6192A	TRANSMIT SHIELD KIT
TLN5891A	RECEIVER SHIELD KIT
TRN6573A	OSCILLATOR MOUNTING KIT

EPS-21203-A

FACTORY INSTALLED OPTIONS

OPTION PLAN NUMBER OR OPTIONAL KIT NUMBER	DESCRIPTION	PUBLICATION REFERENCE	
		APPLICABLE SECTION WITHIN THIS MANUAL	PART NUMBER OF SEPARATE PUBLICATION
DC REMOTE CONTROL STATION OPTIONS			
C63	TLN4637A Paging Module	None	68P81025E60
C143	TLN4664A Repeater Control Module	None	68P81025E60
TONE REMOTE CONTROL STATION OPTIONS			
C56 OR C63	TLN4667A F2-R2 Mute Control Module TLN1253A Paging Control Module	None None	68P81025E60 68P81025E60
TLN1249A OR TLN1250A OR TLN1251A	Squelch Control Module Repeater Control Module "PL" Control Module	None None None	68P81025E60 68P81025E60 68P81025E60
TLN1252A	"Wild Card" Module (See Note 3)	None	68P81025E60
TRN6326A	Digital "PL" 2-User Module (community rptr only)	None	None
C269	Spectra TAC Encoder	None	68P81107E40
OPTIONS APPLICABLE TO BOTH DC AND TONE REMOTE CONTROL STATIONS			
C31BV	Transmit Only Station (Delete Receiver) Carrier Squelch	None	None
C31BW	Transmit Only Station (Delete Receiver) "Private-Line" Squelch	None	None
C31BY	Transmit Only Station (Delete Receiver) "Digital Private-Line" Squelch	None	None
C140	AND Squelch Control	Receiver Interconnect Unit	None
C144 OR C144AB	TLN4668A 4-Wire Audio (1-Rcvr) TLN4668A 4-Wire Audio (2-Rcvr)	None None	68P81025E60 68P81025E60
TLN1181A	Single-Tone Decoder Module	None	68P81025E60
TLN4636A	Time-Out Timer Module	None	68P81025E60
C149	DC Metering W/Monitor Intercom	None	None
C226	Service Intercom W/Speaker	None	None
C36	75" Outdoor Cabinet ("Compa-Station")	68P81033E42	None
C75	Omit Time-Out Timer Module	None	None
TLN4151A	Relay Kit	None	68P81025E60
C84, 86	Omit Wire Line (rptr stations only)	None	None
TMN6071	Test Microphone	None	None
C501	Omit 1 Transmitter Channel Element	None	None
C502	Omit 2 Transmitter Channel Elements	None	None
C521	Omit 1 Receiver Channel Element	None	None
C522	Omit 2 Receiver Channel Elements	None	None
TLN4399A	AC Power Surge Supressor (120 V)	None	None
TLN4662A	Field Installed Squelch Gate Module	None	None
TDF6110	Duplexer	None	None
C27	46-Inch Outdoor Cabinet ("Compa-Station")	68P81033E46	None
U27	75-Inch Outdoor Cabinet (Upright Station)	68P81033E42	None

NOTES:

1. The options listed are not necessarily compatible with each other or with each type of station. Consult your Motorola representative for compatibility details.
2. Other options may become available after the printing of this instruction manual. Consult your Motorola representative for a complete listing of the current options available for your station.
3. One to four TLN4151A Relay Kits may be used with this option to provide one to four form "C" contact closures for operation of external equipment.
4. TLN1745A Service Intercom Kit is identical to TLN1740A DC Metering W/Monitor Intercom Kit but less dc metering feature.

CONDENSED CONTENTS

TAB 1

DESCRIPTION
INSTALLATION
MAINTENANCE

TAB 2

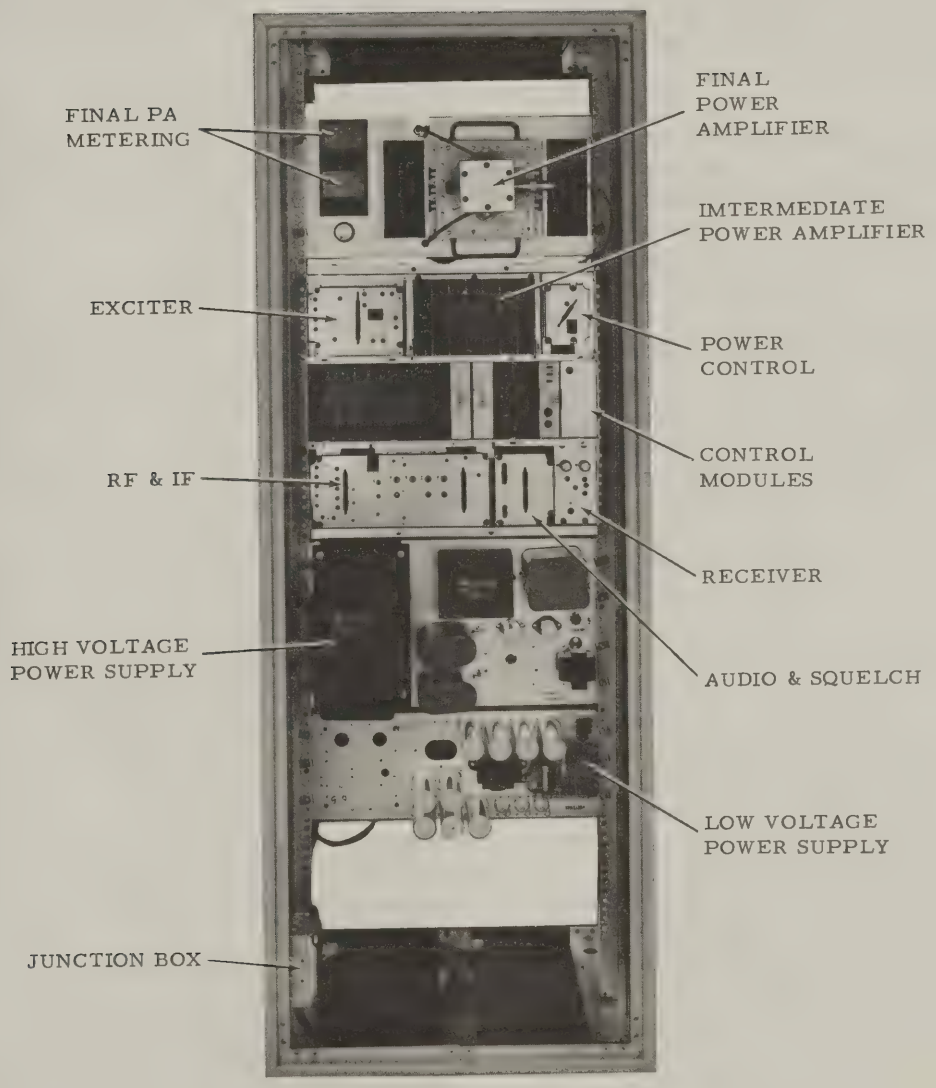
EXCITER/1ST BANDPASS FILTER
TRIPLER AND DOUBLER
INTERMEDIATE POWER AMPLIFIER
DIRECTIONAL COUPLER
POWER CONTROL BOARD
FINAL POWER AMPLIFIER
TRANSMITTER INTERCONNECT BOARD
TONE "PL" ENCODER
"DIGITAL PL" ENCODER (SIMPLEX)
"DIGITAL PL" ENCODER (DUPLEX)

TAB 3

RF AND I–F DECK
AUDIO AND SQUELCH BOARD
AUDIO POWER AMPLIFIER
TONE "PL" DECODER
"DIGITAL PL" DECODER

TAB 4

HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY



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1. MANUAL USAGE

This manual describes all aspects of 806-866 MHz "Micor" type Upright and "Compa-Station" radios except remote control and station applications. Separate CONTROL and APPLICATIONS manual 68P81025E60 describes how these stations are remotely controlled and outlines the various types of base and repeater stations and their applications.

2. 800 MHz CONSIDERATIONS

Radio equipment operating in the 800 MHz band requires some special considerations over and above requirements for radios operating at lower frequencies. Some of these special considerations are:

•TEST EQUIPMENT - Test equipment must cover the frequency range and have the accuracy required. The 800 MHz base station transmitters have a frequency stability requirement of 0.0001%, therefore, stability of frequency measuring devices should be at least ten times that of the transmitter (i.e. 0.00001%). Frequency generators used for alignment should be calibrated for both frequency and output in the 800 MHz band. Wattmeters, dummy loads, and termination devices should be checked for proper frequency specifications and calibrated required.

•CABLES AND CONNECTORS - Cable and connector attenuation is much higher at 800 MHz than at lower frequencies. Therefore, types RG8 and RG58 cables used at lower frequencies are not recommended for the 800 MHz band. Where flexible cable is required, recommended types are RG87 and RG400. "UHF" type connectors are not recommended for this frequency, instead, type "N" and "BNC" connectors are recommended. A particular phenomenon which will be noticed at 800 MHz is cable heating. Under normal operating conditions, rf cables will become warm or even hot. This is a normal condition and does not necessarily indicate a defective cable or a high VSWR ratio. To confirm malfunctions, insert a directional wattmeter in the line.

3. EQUIPMENT DESCRIPTION

3.1 TRANSMITTER

NOTE

Stations in the 800 MHz band are FCC-licensed to operate at or below a specified effective radiated power (ERP). The ERP of the station is related to the rf power output of the transmitter, antenna transmission line loss, antenna height and antenna gain. The maximum rf power output of the transmitter that will be permitted without violating the licensed ERP for each specific station must be determined by a communications specialist. This rf power figure may be equal to or below the maximum capability of the station. Record the figure for reference in future servicing and alignment of the station.

The transmitter generates a frequency modulated rf carrier signal of various power output levels. Refer to figure 1 (block diagram) for functional operation. The transmitter consists of the following items:

--Channel Element - A high stability, oven controlled crystal oscillator plug-in module (channel element) provides a stable fundamental rf frequency for the transmitter. One channel element is used for each transmitter frequency.

--Exciter - the exciter provides the low power excitation signal for the transmitter. An "IDC" (instantaneous Deviation Control) circuit amplifies and limits audio signals from the microphone (or line) to prevent over deviation. Amplified audio is applied to the channel element to produce direct fm modulation. Multipliers in the exciter multiply the channel element frequency 12 times to generate an output frequency signal in the 141 to 145 MHz band.

--First Bandpass Filter - The first bandpass filter couples 141-145 MHz signals from the exciter to the tripler and doubler and attenuates any harmonics outside this band.

--Tripler and Doubler - Exciter output is tripled and doubled in these stages. A bandpass filter, electrically located between the tripler and doubler, filters the tripled signal and attenuates harmonics. A low level amplifier couples the doubler output to the intermediate power amplifier.

--Intermediate Power Amplifier (IPA) - The IPA is a variable 14 W amplifier used to drive the final power amplifier. Amplification is controlled by the power control board.

--Directional Coupler - The directional coupler samples forward power from the IPA and reflected power from the final power amplifier and applies both to the power control board.

--Power Control Board - The power control board operates as a control loop which examines forward and reflected power. It regulates the bias to the IPA, the drive power to the PA, and protects against excessive VSWR.

--Final Power Amplifier - The final power amplifier employs an EIMAC 3CX400U7/8961 UHF Transmitting Triode to provide a final rf power output of 60 to 125 watts. The unit is driven by the rf signal from the directional coupler. The output passes through a harmonic filter and is applied to the antenna output connector (antenna relay on base stations).

3.2 RECEIVER

The receiver accepts rf carrier signals on a specific channel in the 806-820 MHz range and provides voice audio in the 300-3000 Hz range. Refer to figure 1 (block diagram) for functional operation. The receiver consists of the following items:

--Channel Element - a plug-in, temperature compensated crystal oscillator module (channel element) provides stable frequency control for each frequency of operation. One channel element is required for each receiver frequency.

--Receiver RF and IF Board - This double conversion, superheterodyne FM receiver includes a five cell preselector and three crystal filters for excellent selectivity. Two integrated circuit i-f amplifiers and limiters provide high sensitivity. A crystal discriminator demodulates the audio directly from an 11.7 MHz second i-f signal.

--Audio & Squelch and Audio Power Amplifier Boards - Up to 10 watts of audio power at less than 5% distortion is provided by this circuit. When no messages are being received, the squelch circuit turns off the audio amplifiers to eliminate annoying noise in the speaker. A squelch tail eliminator circuit prevents the noise burst at the end of a message for strong signals. For weak signals, the circuit is automatically inhibited to prevent loss of portions of messages. The audio power amplifier transistors are mounted on a separate circuit board and aluminum heat sink for good head dissipation.

--Second Receiver Coupler - With 2-receiver station, a 2-receiver coupler is used. This unit permits two receivers to operate from the same antenna. The coupler has a maximum insertion loss of 4 dB to each receiver.

3.3 POWER SUPPLY

This station uses a high and low voltage power supply system to provide station dc operating voltages. The station cabinet is provided with a safety interlock switch to reduce shock hazard.

--High Voltage Power Supply - The high voltage power supply produces the necessary voltages for plate current and PA tube bias and the ac voltages used to drive the low voltage power supply. It employs a ferro-resonant transformer to maintain output voltages to within ±3% with a ±20% line change.

--Low Voltage Power Supply - This power supply produces regulated dc voltages for the PA tube filament and all the solid-state circuitry of the station. It employs a filament protection and timing circuit for transmit inhibit during station warm-up.

4. VOLUME AND SQUELCH CONTROLS

Receiver VOLUME and SQUELCH controls are located on the receiver chassis (all other operational ciacuit and their controls are on plug-in modules inserted into the unified control chassis). The RECEIVER VOLUME control only affects local speaker operation (when used).

NOTE

The SQUELCH control affects local and remote operation.

5. "PRIVATE-LINE TONE-CODED SQUELCH OPERATION

5.1 This type of operation permits private communications on crowded radio communication channels. Several "Private-Line" (PL) networks can use the same rf carrier frequency in the same area if each network uses a different PL tone frequency. The PL tones are in the 67-210 Hz range, which is below the 300-3000 Hz voice frequency range used in radio communication equipment.

5.2 The transmitters are modulated by a continuous sub-audible PL tone in addition to the voice modulation. The tone is generated by a PL encoder, which is a plug-in circuit board in the transmitter. The receivers accept only signals that are modulated with the

specific PL tone frequency. Signals without the tone or with a different tone are not heard. Thus, only messages from your own PL network are heard. A PL decoder, which is also a plug-in circuit board in the receiver, disables the audio circuits of the receiver until the proper tone is received. A filter blocks the tone from the speaker so that it will not be heard.

5.3 In PL radio systems, the operator will not hear all on-frequency signals until the PL disables the receiver. The PL decoder is bypassed and the receiver reverts to carrier noise type squelch control. It is necessary to monitor the channel before transmitting to avoid interfering with other users.

NOTE

The Motorola Systems Engineering Department assigns the PL tone frequencies to prevent duplicate or interfering tones from being used in the same area. Consult them before changing tones or adding new ones.

6. "DIGITAL PRIVATE-LINE BINARY-CODED SQUELCH OPERATION

This type of operation is similar to "Private-Line" tone-coded squelch operation but with greatly expanded code capability. Refer to separate Instruction Section 68P81106E83 for complete details.

7. ACCESSORIES

In addition to the base and repeater stations described in this manual, some additional items are needed to complete the installation as follows:

7.1 ANTENNA AND TRANSMISSION LINE

An antenna and transmission line kit is available from Motorola on separate order. The type used should be determined by a qualifed radio communications engineer and will depend upon local operating conditions.

7.2 REMOTE CONTROL CONSOLE

A remote control console is required at the control location for this station. It must be compatible with the station; that is, it must supply the audio and control commands of this type that will be accepted by the station.

7.3 OPTIONAL ACCESSORIES

Many optional accessories are available as factory installed items in new stations, and as "add-to" items for field installation. Many of those optional accessories are described in this manual. Other accessories may become available after the printing of this manual. Also, other accessories are available which have more special application than those listed herein. See your local Motorola representative and the Factory-Installed Options List for complete details.

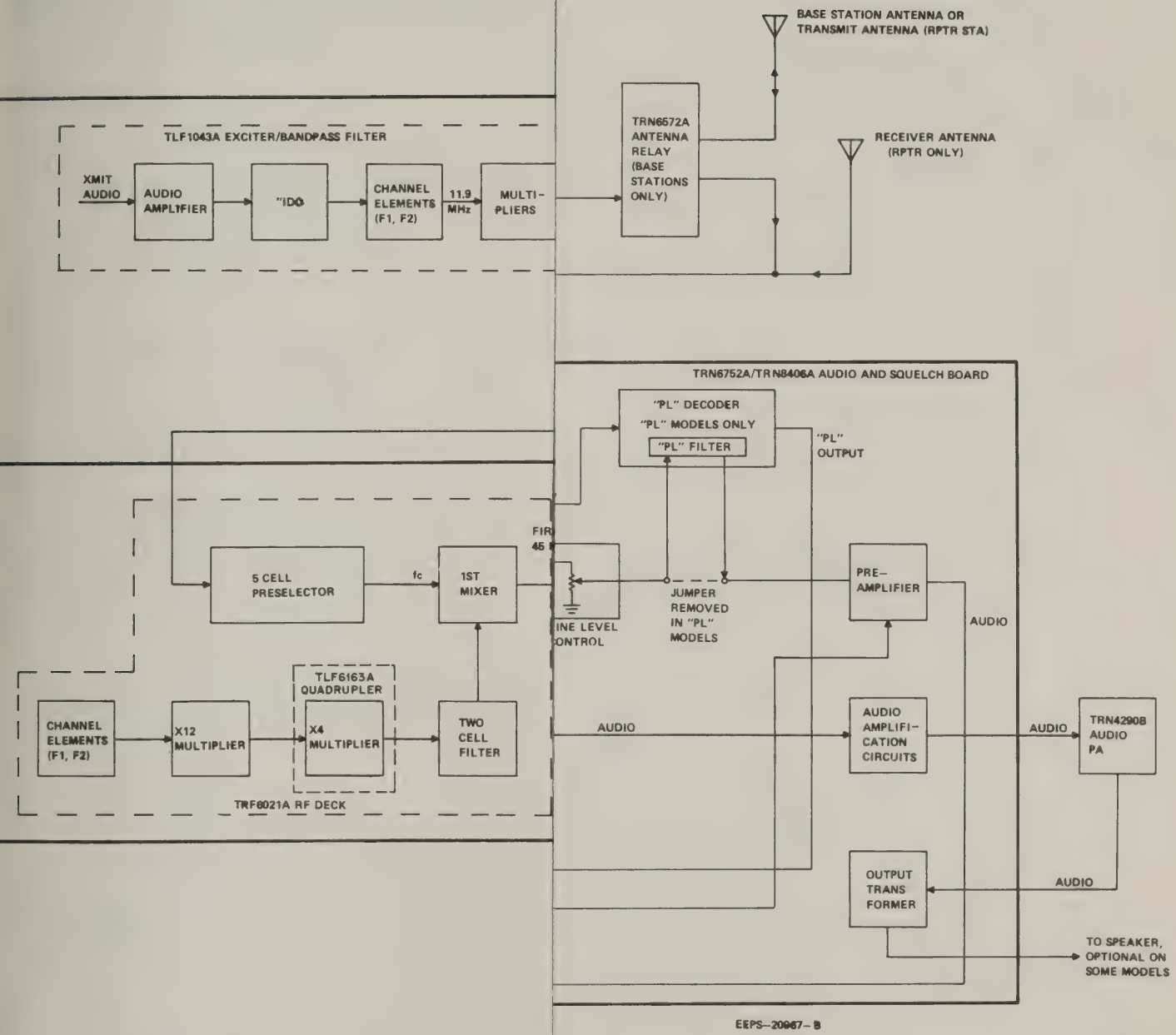

Figure 1. Transmitter-Receiver Block Diagram

specific PL tone frequency. Signals without the tone or with a different tone are not heard. Thus, only messages from your own PL network are heard. A PL decoder, which is also a plug-in circuit board in the receiver, disables the audio circuits of the receiver until the proper tone is received. A filter blocks the tone from the speaker so that it will not be heard.

5.3 In PL radio systems, the operator will not hear all on-frequency signals until the PL disables the receiver. The PL decoder is bypassed and the receiver reverts to carrier noise type squelch control. It is necessary to monitor the channel before transmitting to avoid interfering with other users.

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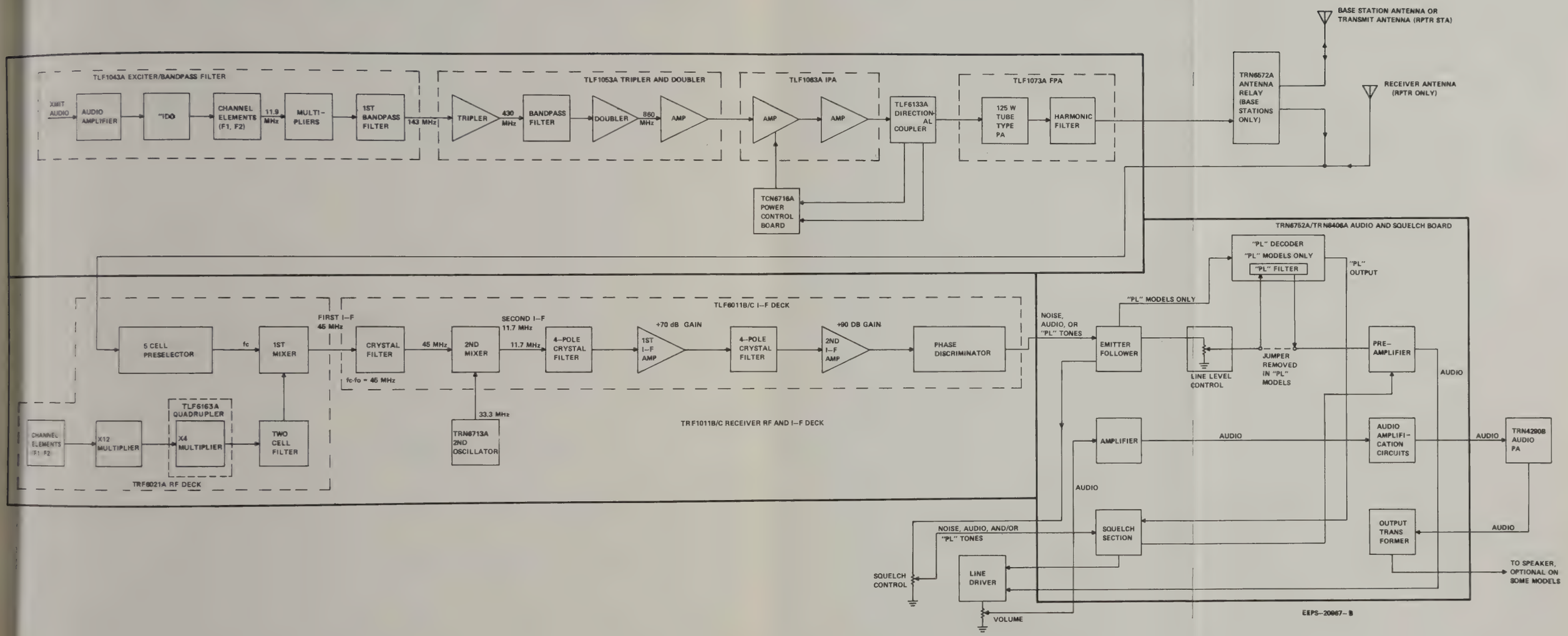

Figure 1. Transmitter-Receiver Block Diagram

INSTALLATION & INITIAL ADJUSTMENTS

IMPORTANT

FCC regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a 1st or 2nd class commercial radiotelephone operator's license or by personnel working under their immediate supervision.

2. The rf power output of a radio transmitter shall be no more than that required for satisfactory technical operation considering the area to be covered and local conditions.

3. Frequency, deviation and power of a base station transmitter must be checked before it is placed in service and rechecked every year thereafter.

REMEMBER

The efficiency of the equipment depends upon a good installation.

1. INSPECTION

Inspect the equipment thoroughly as soon as possible after delivery. If any part of the equipment has been damaged in transit, report the extent of damage to the transportation company immediately.

2. PLANNING THE INSTALLATION

Since a good installation is so important to obtain the best possible performance of the communications system, carefully plan the installation before actual work is started. Location of the station in relation to power, control lines, the antenna, convenience and access for servicing should be considered. The cabinet dimensional detail diagrams show the size of the various cabinets for planning the space requirements. Read the entire procedure and the many suggestions offered to help you plan your installation. Make sure all tools, equipment and facilities are available when the installation is begun.

3. VENTILATION

Although a blower has been provided for cooling the PA tube, the remaining cabinet components are designed for operation without forced ventilation. The cabinet door has openings at the top and bottom, which provide a natural draft. It is therefore essential that the door openings be kept free of obstructions so air flow will not be restricted.

4. INSTALLATION OF 60—INCH INDOOR "COMPA—STATION" CABINETS

4.1 Refer to cabinet drawings at the end of this section for cabinet dimensional details.

4.2 The cabinet should be located on a solid, level surface convenient to the power

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source and the transmission line. The transmission line should be kept as short as possible to minimize line losses.

4.3 All antenna, power and control lines may be brought through the notch at the bottom of the rear door. Any or all of these lines may be brought out through the bottom, side or top of the cabinet, if desired, by drilling a hole in the cabinet at the desired position.

CAUTION

Before drilling, check location of proposed hole and verify that equipment will not be damaged by the drilling.

5. INSTALLATION OF 75—INCH "OUTDOOR" CABINETS (OPTIONAL)

5.1 GENERAL

5.1.1 Refer to cabinet drawings at the end of this section for cabinet dimensional details.

5.1.2 The outdoor station may be installed in any convenient location (indoors or outdoors) which provides space to open the front and rear doors. If it is installed outdoors, the rain shield kit (which is packed with the cabinet) should be installed as described in this section. With these installed, the station is protected against all normally encountered elements such as rain, snow or sleet.

5.1.3 The station is not intended to withstand submersion in water. If pools of water could gather around the cabinet base, it is recommended that the cabinet be elevated on a suitable supporter platform.

5.1.4 Although the cabinet is built to be installed outdoors, it should be realized that maintenance of the station is not easily accomplished in inclement weather. It is therefore recommended that the station be installed inside of an enclosure which would provide protection for the serviceman and the test equipment he may be using. One such enclosure would be an elevator penthouse or a small building no less than six feet square and eight feet tall as measured on the inside.

5.1.5 The cabinet should be located on a solid, level surface convenient to the power source and the transmission line. The transmission line should be kept as short as possible to minimize line losses.

5.2 75-INCH CABINET RAIN HOOD AND VENT SHIELD INSTALLATION

5.2.1 General

The rain hood is provided to cover the air vent in the top of the cabinet and the vent shield to cover the opening in the rear door.

5.2.2 Installation of Rain Hood

Step 1. Install the main section (largest fabricated assembly) over the opening in the top of the cabinet using the rectangular shaped gasket and 1/2-inch sheet metal screws provided.

Step 2. Mount the small rectangular cover inside the main section using the machine screws provided.

Step 3. Similarly, mount the larger cover on top of the whole assembly.

5.2.3 Installation of Vent Shield

Mount the awning-shaped vent shield over the opening in the rear door using the "U" shaped gasket and 3/8-inch sheet metal screws. Place the acorn nuts over the screws to cover exposed threads.

6. ANTENNA CONNECTIONS

6.1 INTRODUCTION

6.1.1 The antennas and transmission lines are not part of the station. Therefore, antenna installation instructions are not included in this section. Follow the instructions shipped with the antennas for applicable information.

6.1.2 In its primary application, the station is used for communications with mobile radios. Thus antennas having omni-directional characteristics are desirable. However, if the station is located at the outer perimeter of a communications area, or if it is to be used for communications with fixed stations, antennas with specific directional characteristics may be more suitable. FCC requirements may also dictate the type of antenna to be used.

6.1.3 For base stations, the antenna's coaxial cable connects to the antenna network output with a type N connector. For repeater stations without an optional duplexer, two antennas are required, one for the trans-

mitter and one for the receiver. The antenna coaxial cables connect directly to the transmitter and receiver. The transmitter output requires a type N connector at the antenna network output -- the receiver input requires a type BNC connector. For repeater stations with an optional factory installed duplexer, the antenna's coaxial cable connects to the duplexer with a type N connector. (Refer to Figure 1.)

6.1.4 Cable attenuation will be a much greater factor for 800 MHz. Therefore, whenever a flexible cable is needed, the recommended cables will be 30-83794C01 (RG87) and 30-84173E01 (RG400). If flexibility is not a requirement, then a heliax line should be used. In all usage of flexible cable, keep the line as short as possible.

6.2 60-INCH INDOOR CABINET ANTENNA CABLE ROUTING AND CONNECTION

Step 1. The antenna coaxial cable(s) may be brought through the notch at the bottom of the rear door. Cable(s) may be brought out through the bottom, side or top of the cabinet, if desired, by drilling a hole in the cabinet at the desired position.

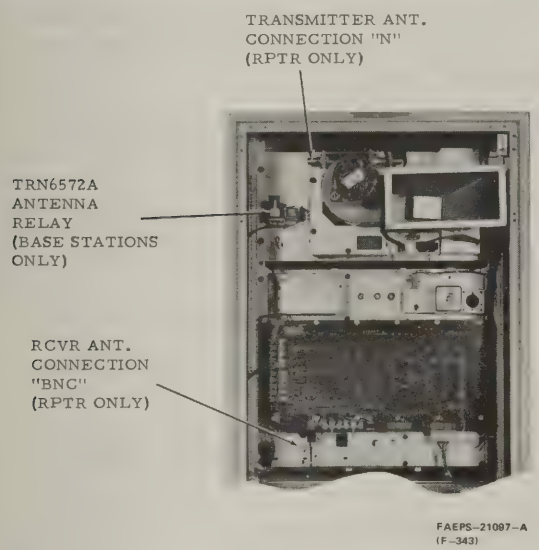

TRANSMITTER ANT. CONNECTION "N" (RPTR ONLY)
TRN6572A ANTENNA RELAY (BASE STATIONS ONLY)
RCVR ANT. CONNECTION "BNC" (RPTR ONLY)
FAEPS-21097-A (F-343)

Figure 1. Antenna Connection Locations

CAUTION

Be careful to determine internal clearance before drilling access holes. A 3/4-inch diameter hole allows conduit to be installed for cable runs. If conduit is not used, install rubber grommets in the holes to protect the cable(s).

Step 2. Connect the antenna cable(s) as shown in Figure 1 and discussed in paragraph 7.1.3.

6.3 75-INCH OUTDOOR CABINET ANTENNA CABLE ROUTING AND CONNECTION

Step 1. A flange-type bulkhead fitting should be used to make a weatherproof entry for the antenna transmission line(s). The recommended location for the fitting is on the right side of the cabinet (as viewed from the front) with its center 21 inches from the top and 7 inches from the rear. Any alternate location must be selected with caution to insure that the area is clear of chassis, framework, etc.

Step 2. Install connectors as required.

7. AC INPUT POWER CONNECTIONS

7.1 INTRODUCTION

7.1.1 All stations should have a separate power circuit from a 10-ampere (minimum), 120-volt ac, 60 Hz power source. The power lines should be installed in accordance with local electrical codes.

7.1.2 The primary ac power line may be installed prior to installation of the cabinet and terminated near the location chosen for the station.

7.1.3 An ac power cord of 9 feet is supplied with each station. Direct conduit connections may also be made by replacing this power cord.

7.2 60-INCH INDOOR/CABINET POWER CONNECTIONS

7.2.1 Indoor and outdoor power connections are identical except that outdoor station requires additional weatherproofing.

WARNING

If a three wire grounded primary ac power source is not available the radio equipment must be grounded separately to prevent electrical shock hazards and provide lightning protection.

7.2.2 Connect the three-wire ac line cord to the ac outlet. A power on-off switch is provided in the equipment.

7.2.3 The Station fuses control all power to the station except ac power to the outlet in the power supply.

7.3 75-INCH OUTDOOR CABINET POWER CONNECTIONS

7.3.1 For bottom cable entry, power and control cables may be brought in at almost any desired point through the bottom of the cabinet. Measure and center punch the desired cable entry locations. Using the center punch marks as the center of the holes, drill 3/4-inch holes with a hold saw. Install rubber grommets in the holes to protect the cables. Seal the entry to make the opening as weatherproof as possible.

7.3.2 For rear cable entry, two punch marks are located on the rear panel of the cabinet base. Using these as centers, drill holes in the cabinet with a 3/4-inch hole saw. When facing the rear, the right-hand hole is intended for the entrance of ac power and the left-hand hole is intended for the entrance of control lines. Install rubber grommets in the holes to protect the cables. Seal the entry to make the opening as weatherproof as possible.

7.4.2 Transmission Lines Terminated in Female Connector

Step 1. Secure the transmission line (through the appropriate knockout) directly to the cabinet top with the nut supplied.

Step 2. Measure and cut a piece of coaxial cable so that it will reach between the station output connector and the transmission line connector in the cabinet top.

Step 3. Install the connectors as required.

8. OPTIONAL MODE JUMPERING

8.1 GENERAL

8.1.1 Many station modes of operation are determined by jumper connections at the time of installation and are described in the following paragraphs.

8.1.2 Additional jumpers used with the station are identified and described in applicable sections elsewhere within this instruction manual.

8.2 TIME-OUT TIMER MODULE

Base stations or repeaters equipped with a time-out-timer module prevent unintentional continuous transmission. The timing jumpers on the module may be connected for 1/2, 1, 2, 4 or 8 minute operation. In repeaters, the time-out-timer will reset each time a new input signal arrives at the station, whether or not the drop-out delay generator has shut off the transmitter. Repeater time-out time and line transmit time periods may be selected independently with the repeater select jumper and the line select jumper.

8.3 SQUELCH GATE

In repeater stations, the dropout delay generator in the squelch gate module prevents the transmitter from shutting off during loss or excessive fade of input signal for the length of time preset. The jumper can be set for 0, 1, 2, 4 or 8 second operation (do not set to "0" in community repeater operation).

8.4 TWO-RECEIVER STATIONS

8.4.1 Stations equipped with two receivers can be connected for receiver #1 priority or receiver #2 priority if desired. A signal received on the priority receiver automatically mutes the other receiver. These jumpers are located on the line driver module.

Receiver #1 priority - JU18 OUT
JU24 IN
Receiver #2 priority - JU18 IN
JU24 OUT

8.4.2 Jumpers in the line driver module also allow receiver #2 to be partially muted (audio attenuation) if desired, rather than the full muting as shipped from the factory. Attenuation of 10 dB, 20 dB or 30 dB in respect to the unmuted condition are possible by jumper connections as follows.

30 dB attenuation - JU25, 26 IN
JU27 OUT
20 dB attenuation - JU25 IN
JU26, 27 OUT
10 dB attenuation - JU25, 26 & 27 OUT

8.4.3 Receiver #2 mute attenuation is a standard feature of dc controlled stations and optional on tone control.

9. CONTROL LINE CONNECTIONS

9.1 INTRODUCTION

The station can be controlled from a remote point over wire line circuits. Simplex audio is used, meaning that the remote point can send audio to the station or receive audio from the station, but not both at the same time. Therefore, a single audio pair will suffice. For dc remote control operation, the wire line must provide dc continuity for carrying the dc control currents. This must be the same pair that carrier the transmit audio. For tone remote control operation the audio pair also carries the audio control tones.

9.2 LINE SPECIFICATIONS

The audio wire line(s) must meet the following specifications for acceptable radio communications. For stations using both tone and dc control, the lines must meet both specifications. Verify the

characteristics of leased telephone lines with the company providing the service before installation.

9.2.1 DC Remote Control Operation

AUDIO LINE REQUIREMENTS

1. FREQUENCY RESPONSE: 500 TO 2500 Hz
2. IMPEDANCE: 600-OHM BALANCED LINE

DC LINE REQUIREMENTS

1. DC RESISTANCE 0 TO 8000 OHMS.
2. MUST HAVE DC CONTINUITY.

9.2.2 Tone Remote Control Operation

FREQUENCY RESPONSE: 500 to 2500 Hz
FREQUENCY TRANSLATION ERROR: ±10 Hz MAX.
IMPEDANCE: 600-OHM BALANCED LINE
SIGNAL-TO-NOISE: 35 dB MIN.

Chart of Maximum Input and Loss

PHONE-COMPANY SPECIFIED MAXIMUM INPUT	MAXIMUM PHONE LINE LOSS USABLE WITH REMOTELY-CONTROLLED RADIO
+8 vu (14 dBm)	32 dB
0 vu (6 dBm)	24 dB
-8 vu (-2 dBm)	16 dB

9.3 INSTALLATION

9.3.1 General

The control line may be installed prior to installation of the cabinet and terminated near the location chosen for the station. Conduit or two-wire cable can be used from this termination to the station cabinet.

9.3.2 Specific Connection Information

Connect the 600-ohm lines to the screw terminals on the rear of the unified chassis interconnect board as shown in Figure 2. (In 2-wire applications, use line 1 connections.)

9.3.3 DC Control Line Levels

When the dc control line is initially connected, it must be tested to assure that its loop resistance is low enough to allow sufficient current for remote operation. Use the following test procedure.

Step 1. Connect a dc milliameter in series with the dc control line.

Step 2. Have the operator press the push-to-talk switch at the remote control console.

Step 3. The current must be at least +5.5 mA to key the transmitter and at least +10 mA for two-frequency transmitters. Check to see that the current is positive and not negative and that the station is actually keyed. Adjust the remote control console for F1 line current until +5.5 mA is achieved. For a two-frequency transmitter, adjust the remote control console for F2 line current of 10 to 12 mA.

If the line loop resistance is too high, the maximum line current from the console will not key the transmitter. There are two alternatives to correct this problem.

--Use a pair of lines having lower resistance while maintaining proper audio response, or

--Use an alternate pair of lines with lower resistance to carry dc current only. This pair need not have good audio loss or response characteristics.

Adjust the line current for "Private-Line" disable at the remote control console for -2.5 mA, if a "Private-Line" model is being adjusted.

9.3.4 Tone Control Line Levels

The control tone levels for the remotely controlled functions are adjusted at the remote control console. No additional adjustments are required.

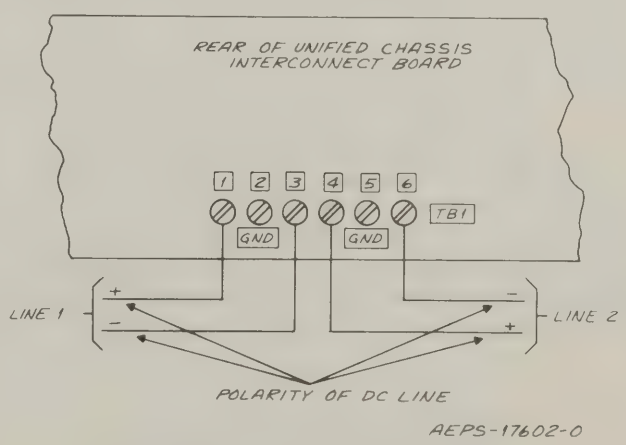


Figure 2.
Control Line Connections

10. CONTROL LINE LEVEL ADJUSTMENT

10.1 INTRODUCTION

Most telephone companies limit the maximum signal amplitude which they will allow on their lines. This maximum amplitude is usually specified in RMS speech level is approximately 4 dB lower than a tone set at speech peaks. Therefore, when a tone set at peak speech level (such as the status tone from a "Spectra TAC" receiver) is used to set line level, it may be set 4 dBm above the specified RMS speech level.

10.2 PROCEDURE

10.2.1 General

10.2.1.1 A local speaker at the station may be used for testing and level settings. If the station is equipped with built-in metering, it includes a local speaker. If not, the speaker in a Motorola portable test set may be used by connecting the test set with "Micor" adapter to the control receptacle (J3) on the unified chassis interconnect board. Otherwise, a "Micor" mobile speaker can be connected to the local speaker pins (J4-1 and -12 of unified chassis interconnect board). The receiver VOLUME control sets the audio level at the local speaker only.

10.2.1.2 Exciter audio should be measured at the microphone input to the exciter and adjusted for the sensitivity value stamped on the exciter. If the station is equipped with optional built-in metering, this may be measured at pins 1 and 2 of the local microphone jack. If not, it may be measured at J4-15 and -14 of unified chassis interconnect board or on the portable test set.

10.2.1.3 "Private-Line" receivers must be PL disabled during adjustments with the PL DISABLE switch on the station control module. In "Private-Line" repeaters, the squelch gate must also be set for carrier squelch operation during adjustments by connecting jumper JU14 to the active pin and JU15 to the dummy pin. Be sure to return the jumpers to the PL condition after adjustments are complete.

10.2.1.4 If the station is equipped with a single-tone decoder module for repeater access unplug the single-tone decoder during adjustments.

10.2.2 Repeater Level Setting

Step 1. Set the receiver SQUELCH control at squelch threshold.

Step 2. Inject an on-frequency carrier signal into the receiver antenna input. Adjust the signal level to 20 dB quieting.

Step 3. Adjust the REPEATER SQUELCH KEY control (squelch gate module) so the transmitter just keys.

Step 4. Modulate the receiver input with a 1000-Hz tone at ±4 kHz deviation. Adjust the REPEATER LEVEL control (squelch gate module) so the exciter audio input is the value stamped on the exciter (modulator sensitivity +6 dB or approximately ±4 kHz transmitter deviation).

10.2.3 Wire Line Controlled Base Stations and Repeater Stations

10.2.3.1 Determine the maximum allowable audio level permitted on the lines (use +8 vu for non-regulated lines) and set line audio levels to this amplitude. Refer to the 600-OHM, VU, DBM AND VOLTAGE EQUIVALENCY CHART for tone levels to be used.

NOTE

The following procedures assume the +8 vu speech level (+14 dBm tone level). For other speech levels, use a tone level 6 dB higher than the vu level (for 0 vu use +6 dBm); refer to the equivalency chart. On some lines, tone levels are not permitted to exceed the speech levels, even for short test tones (for example, maximum speech level of 0 vu and maximum tone level of 0 dBm). When such regulations apply, use the special procedures for low level test tone.

10.2.3.2 As mentioned previously, the lines used to carry audio have an ac impedance of 600 ohms. The amplitude of signals is most conveniently measured in dBm. Zero dBm is equal to 1 milliwatt across 600 ohms. Most audio voltmeter, such as the Motorola Transistorized AC Voltmeter, are calibrated to read directly in dBm when measuring across a 600-ohm impedance. Never use a volt-ohm meter or a multimeter.

Step 1. Apply a 100-Hz audio tone to the remote control console at a level sufficient to drive the amplifier into compression. Adjust the output of the remote control console for +14 dBm (or maximum allowable audio level) at its output terminals. If the level at the station is above 0 dBm, remove JU1 on the station control module.

Step 2. Adjust the the XCTR LEVEL control (station control module) so that the exciter audio input equals the value stamped on the exciter (Modulator sensitvity plus 3 dB or approximately ±5 kHz transmitter deviation).

Step 3. Remove the 1000 Hz audio tone.

Step 4. Set the receiver SQUELCH control for squelch threshold.

Step 5. Inject a 1000 uV carrier frequency signal into the antenna input of the receiver. Modulate the signal with a 1000-Hz tone at ±5 kHz deviation.

Step 6. Adjust the LINE 1 OUTPUT (line driver module) for +14 dBm (3.9 V) or maximum allowable audio level as measured with an audio voltmeter across the line 1 terminals. If four-wire audio operation is used, with the receiver output applied to line 2, adjust the LINE 2 OUTPUT control while measuring across the line 2 terminals.

Step 7. If the station has two receivers, both feeding to line 1, set the LINE 1 OUTPUT control as specified with a ±5 kHz modulated carrier signal injected into receiver 1. Next, inject a ±5 kHz modulated carrier into receiver 2. If the line output on the voltmeter changes by more than 2 dBm, readjust the potentiometer on the receiver 2 audio and squelch board to match the receiver 1 reading.

Step 8. If the station has two receivers, each on a different line, adjust LINE 1 OUTPUT with a modulated carrier injected into receiver 1, and adjust LINE 2 OUTPUT with a modulated carrier injected into receiver 2.

10.2.4 Special Procedure for Low Level Test Tone

NOTE

The following procedure is written for the 0 vu speech level and 0 dBm test tone level, but other levels may be used by substituting appropriate levels (levels across the 600-ohm load should be 6 dB higher than the specified line level).

Step 1. Terminate the remote control console in a 600-ohm load resistor rather than the line.

Step 2. Apply a 1000-Hz audio tone to the remote control console at a level sufficient to drive the amplifier into compression.

Step 3. Connect an audio voltmeter across the 600-ohm load resistor and adjust the line output for +6 dBm.

Step 4. Reduce the 1000 Hz audio tone input until the voltmeter reads 0 dBm.

Step 5. Remove the 600-ohm load resistor and reconnect the line. Readjust the line output for 0 dBm across the line. Do not change the 1000 Hz tone level.

Step 6. Connect the audio voltmeter to the exciter audio input at the station and adjust the XCTR LEVEL control for 6 dB less than the value stamped on the exciter.

Step 7. Disconnect the line at the station and connect a 600-ohm load resistor in its place.

Step 8. Apply a 1000 uV carrier signal to the receiver antenna terminal from an FM signal generator. Modulate the carrier signal with a 1000 Hz tone at ±5 kHz deviation.

Step 9. Connect an audio voltmeter across the 600-ohm load resistor and adjust the LINE 1 OUTPUT control for +6 dBm.

Step 10. Reduce the deviation until the voltmeter reads 0 dBm.

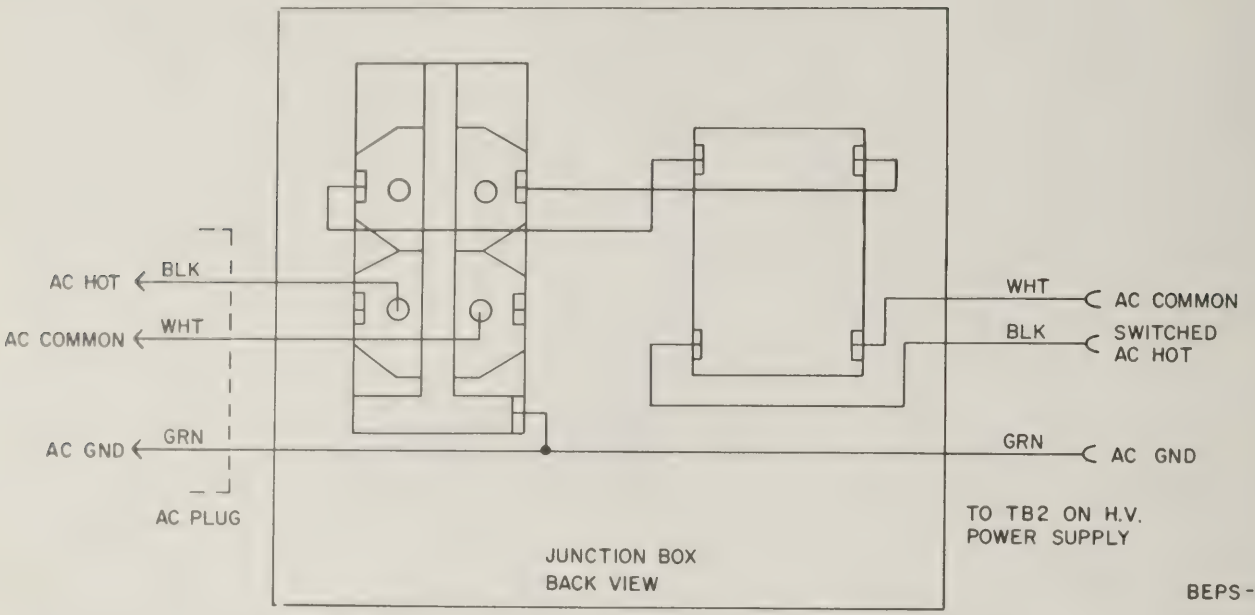
Step 11. Remove the 600-ohm load resistor and reconnect the line. Readjust the LINE 1 OUTPUT for 0 dBm as measured across the line.

POWER JUNCTION BOX

MODELS TRN6587A (60" INDOOR)
AND TRN5695A (75" OUTDOOR) OPTIONAL

FUNCTION :

Provides ac power inputs to the station.



BEPS-21052-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

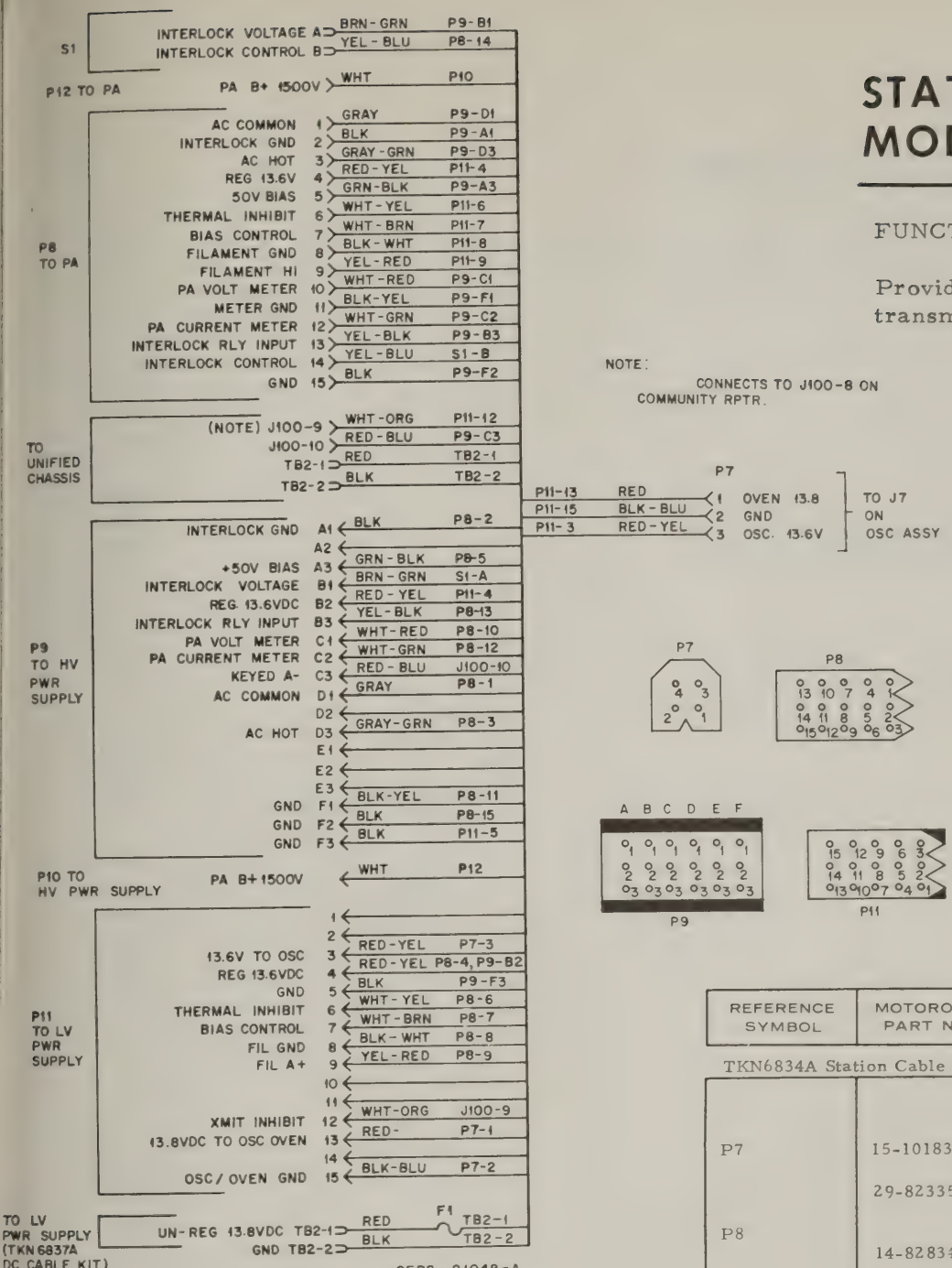
TRN6587A and TRN5695A Junction Box PL-4383-A

J1	9-891865	CONNECTOR, receptacle: dual AC outlet
P1		CONNECTOR, plug: part of W1
S1	40-82041K01	SWITCH, toggle: dpst
W1	30-83849E01	CABLE: AC line cord; includes refer P1 (TRN6587A only)
	MECHANICAL PARTS	
	7-84617H01	BOX, outlet
	15-82025K01	COVER, box; outlet
	29-824154	LUG for #10 lead (TRN6587A only)
	29-845081	LUG for #8 lead (TRN6587A only)
	42-84618H01	CLAMP, cord; 2 req'd.
	64-82314L01	PLATE (TRN6587A only)
	1-80762B68	LEAD ASSEMBLY (gray-green) Includes:
	29-848901	LUG, solderless; 2 req'd.
	1-80762B69	LEAD ASSEMBLY (white) Includes:
	29-848901	LUG, solderless; 2 req'd.
	1-80762B70	LEAD ASSEMBLY Includes:
	29-847854	LUG, slotted tonque
	29-848902	LUG, solderless; 4 req'd.

STATION CABLE KIT MODEL TKN6834A

FUNCTION -

Provides interconnections between transmitter boards.


S1
INTERLOCK VOLTAGE A
INTERLOCK CONTROL B
BRN-GRN P9-B1
YEL-BLU P8-14
P12 TO PA
PA B+ 1500V
WHT P10
P8 TO PA
AC COMMON 1 GRAY P9-D1
INTERLOCK GND 2 BLK P9-A1
AC HOT 3 GRAY-GRN P9-D3
REG 13.6V 4 RED-YEL P11-4
50V BIAS 5 GRN-BLK P9-A3
THERMAL INHIBIT 6 WHT-YEL P11-6
BIAS CONTROL 7 WHT-BRN P11-7
FILAMENT GND 8 BLK-WHT P11-8
FILAMENT HI 9 YEL-RED P11-9
PA VOLT METER 10 WHT-RED P9-C1
METER GND 11 BLK-YEL P9-F1
PA CURRENT METER 12 WHT-GRN P9-C2
INTERLOCK RLY INPUT 13 YEL-BLK P9-B3
INTERLOCK CONTROL 14 YEL-BLU S1-B
GND 15 BLK P9-F2
TO UNIFIED CHASSIS
(NOTE) J100-9 WHT-ORG P11-12
J100-10 RED-BLU P9-C3
TB2-1 RED TB2-1
TB2-2 BLK TB2-2
NOTE:
CONNECTS TO J100-8 ON COMMUNITY RPTR.
P7
P11-13 RED 1 OVEN 13.8 TO J7
P11-15 BLK-BLU 2 GND ON
P11-3 RED-YEL 3 OSC. 13.6V OSC ASSY
P9 TO HV PWR SUPPLY
INTERLOCK GND A1 BLK P8-2
A2
+50V BIAS A3 GRN-BLK P8-5
INTERLOCK VOLTAGE B1 BRN-GRN S1-A
REG 13.6VDC B2 RED-YEL P11-4
INTERLOCK RLY INPUT B3 YEL-BLK P8-13
PA VOLT METER C1 WHT-RED P8-10
PA CURRENT METER C2 WHT-GRN P8-12
KEYED A- C3 RED-BLU J100-10
AC COMMON D1 GRAY P8-1
D2
AC HOT D3 GRAY-GRN P8-3
E1
E2
E3 BLK-YEL P8-11
GND F1 BLK P8-15
GND F2 BLK P8-15
GND F3 BLK P11-5
P10 TO HV PWR SUPPLY
PA B+1500V WHT P12
P11 TO LV PWR SUPPLY
1
2
13.6V TO OSC 3 RED-YEL P7-3
REG 13.6VDC 4 RED-YEL P8-4, P9-B2
GND 5 BLK P9-F3
THERMAL INHIBIT 6 WHT-YEL P8-6
BIAS CONTROL 7 WHT-BRN P8-7
FIL GND 8 BLK-WHT P8-8
FIL A+ 9 YEL-RED P8-9
10
11
XMIT INHIBIT 12 WHT-ORG J100-9
13.8VDC TO OSC OVEN 13 RED- P7-1
14
OSC/OVEN GND 15 BLK-BLU P7-2
TO LV PWR SUPPLY (TKN6837A DC CABLE KIT)
UN-REG 13.8VDC TB2-1 RED F1 TB2-1
GND TB2-2 BLK TB2-2
CEPS-21048-A
P7
P8
A B C D E F
P9
P11

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
TKN6834A Station Cable Kit		PL-4432-A
		CONNECTOR:
P7	15-10183A64	includes: INSULATOR; connector (4-contact)
	29-82335A01	CONTACT, male; 3 req'd.
P8		includes:
	14-82834H01	INSULATOR, connector (15-contact)
	29-82336A01	CONTACT, female; 11 req'd. single contact (p/o HV cable)
P9		includes:
	14-82337A07	INSULATOR, connector (18-contact)
	29-82335A01	CONTACT, male; 12 req'd. single contact (p/o HV cable)
P11		includes
	14-82836H01	INSULATOR, connector (15-contact)
	29-82335A01	CONTACT, male; 10 req'd.
NON-REFERENCED ITEMS		
	29-83883C06	LUG, solderless; 2 req'd.
	39-10184A24	TERMINAL, female; 2 req'd.
	42-10217A02	STRAP, cable harness; 1/16 to 5/8"; 22 req'd.
	42-10217A10	STRAP, cable harness, 1/16 to 1-3/4"; 3 req'd.
	30-82905H01	HIGH VOLTAGE CABLE includes: CONNECTOR P10 & 12

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TKN6837A DC Cable Kit PL-4431-O

F1	65-86099	FUSE: 7.5A; 32 V
NON-REFERENCED ITEMS		
	1-80788B32	CABLE ASSEMBLY, includes:
	14-82882A01	BODY, fuseholder
	14-82883A01	CAP, fuseholder
	29-84078B01	LUG, slotted tongue; 4 req'd.
	41-82885A01	SPRING, fuseholder
	42-10217A02	STRAP, cable harness; 8 req'd/
	42-82884A01	CLIP, fuse; 2 req'd. FUSE F1
	1-80775B84	LEAD ASSEMBLY, includes:
	9-83012H01	CONTACT, female; 6 req'd.
	15-83498F06	HOUSING, connector; 6-contact
	29-83499F01	CONTACT, male; 6 req'd.
	42-10217S02	STRAP, cable harness; 3 req'd.

PEPS-21049-B
12/18/76-NPC

STATION CABLE KIT

UPRIGHT OUTDOOR CABINET

OPTION U27 (FOR UPRIGHT STATIONS)
OPTION C36 (FOR "COMPA-STATION" BASE RADIOS)

FEATU

-- Wate
-- Thic
-- Vent
-- Vent

CABIN

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-- Shad
-- Mini

INSTA

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sheet
-- Insta
-- Simil
-- Mou
Place

PERIO

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steel
-- Wipe
-- Appl
minu

-- The a
11-82
paint

-- The
North

NOTES

1. THE INDOOR CABINET FRONT AND REAR DOORS CAN BE CHANGED TO ALLOW LEFT-HAND OPENING INSTEAD OF RIGHT-HAND OPENING.
2. IF THE DOOR OPENING CHANGE MENTIONED IN NOTE 1 IS MADE, BE SURE TO RELOCATE THE VENT COVER TO THE UNUSED OPENING
3. ELEVATE OUTDOOR CABINETS IF DANGER OF WATER SUBMERSION EXISTS
4. DOORS ON OUTDOOR CABINET ARE NOT REMOVABLE.
5. STATIONS OVER 110 WATTS OUTPUT USE TRN6720A VENT KIT. STATIONS BELOW 110 WATT OUTPUT USE TRN6721A VENT SEAL KIT

MODEL	SUFFIX	DESCRIPTION
THN6203A		75" Cabinet
TRN6720A		Rain Hood Vent Kit (for stations over 110 W only)
TRN6721A		Vent Seal Kit (for stations under 110 W only)

DESCRIPTION

PL-5107-O

, spring, #8; 6 used
EW, machine; 8-32 x 3/8";
ed
EW, tapping; 8-18 x 3/8;
ed
EW, tapping; 8-18 x 1/2;
ed
DD, door vent
ER, rain shield
ELD, rain top
ELD, cover top
KET; 13.0 x 4.5"
KET; 13.0 x 7.25"
KET; 6-hole; 2 used
KET; 4-hole; 2 used

68P81033E42-A
8/15/77-NPC

UPRIGHT OUTDOOR CABINET

OPTION U27 (FOR UPRIGHT STATIONS)
OPTION C36 (FOR "COMPA-STATION" BASE RADIOS)

FEATURES

-- Water drainage holes
-- Thick door gaskets
-- Vent seal for stations with less than 110 W output
-- Vent kit for stations with greater than 110 W output

CABINET INSTALLATION

-- Mount on elevated support or platform
-- Shady or cool area if possible
-- Minimum of eight inches for all obstructions

INSTALLATION OF TRN6720A RAIN HOOD VENT KIT

-- Mount main section (largest assembly) over opening in top of cabinet using rectangular shaped gasket and 1/2-inch sheet metal screws provided.
-- Install small rectangular cover inside main section using machine screws provided.
-- Similarly, mount larger cover on top of entire assembly.
-- Mount awning-shaped vent shield over rear door opening using "U" shaped gasket and 3/8-inch sheet metal screws. Place acorn nuts over screws to cover exposed threads.

PERIODIC MAINTENANCE

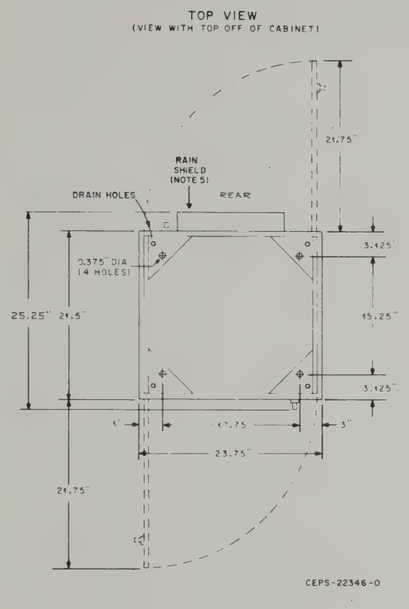
-- Use a paint scraper or putty knife to remove all loose paint and paint blisters from the cabinet. Use a wire brush or steel wool to remove remaining rust from the area. The surface must be cleaned to bare metal and free of all rust.
-- Wipe cleared surface with a clean cloth
-- Apply a thin even coat of primer, Part No. 11S1003A42, to all exposed metal. This coat should dry to the touch in minutes. Apply an even smooth coat of paint, Part No. 11S10026A33 (haze beige).

NOTE

Be sure water drainage holes are cleared of all paint and primer.

-- The above primer and paint are available from Communications Division Parts Department. Spray paint (Part No. 11-82716A05) and spray primer (Part No. ST-4330) are also available from Parts Department. However, spraying paint inside cabinet is not recommended.

-- The above kits and paint can be obtained from Motorola Communications Division Parts Department, 10 West North Avenue, Lombard, Illinois 60148.



NOTES

1. THE INDOOR CABINET FRONT AND REAR DOORS CAN BE CHANGED TO ALLOW LEFT-HAND OPENING INSTEAD OF RIGHT-HAND OPENING
2. IF THE DOOR OPENING CHANGE MENTIONED IN NOTE 1 IS MADE, BE SURE TO RELOCATE THE VENT COVER TO THE UNUSED OPENING
3. ELEVATE OUTDOOR CABINETS IF DANGER OF WATER SUBMERSION EXISTS
4. DOORS ON OUTDOOR CABINET ARE NOT REMOVABLE
5. STATIONS OVER 110 WATTS OUTPUT USE TRN6720A VENT KIT. STATIONS BELOW 110 WATT OUTPUT USE TRN6721A VENT SEAL KIT

MODEL	SUFFIX	DESCRIPTION
THN6203A		75" Cabinet
TRN6720A		Rain Hood Vent Kit (for stations over 110 W only)
TRN6721A		Vent Seal Kit (for stations under 110 W only)

PARTS LIST

THN6203A Cabinet (75-Inch) PL-5198-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	15-82123H05	CABINET, outdoor

TRN6721A Vent Seal Kit PL-5106-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	2-10080A03	NUT, spring; #8; 6 used
	3-132823	SCREW, tapping; #8-18 x 3/8" 4 used
	3-135014	SCREW, tapping; #8-18 x 1/2; 6 used
	26-83956H01	SHIELD (2 hole)
	26-83956H03	SHIELD (1 hole)
	32-82499L01	GASKET; 13.0 x 4.5"
	32-82499L02	GASKET; 13.0 x 7.25"

TRN6720A Rain Hood Vent Kit PL-5107-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	2-10080A03	NUT, spring, #8; 6 used
	3-9661	SCREW, machine; 8-32 x 3/8"; 8 used
	3-132823	SCREW, tapping; 8-18 x 3/8; 4 used
	3-135014	SCREW, tapping; 8-18 x 1/2; 8 used
	15-82433L01	HOOD, door vent
	15-82926H01	COVER, rain shield
	26-82929H01	SHIELD, rain top
	26-84084F01	SHIELD, cover top
	32-82499L01	GASKET; 13.0 x 4.5"
	32-82499L02	GASKET; 13.0 x 7.25"
	32-84180G01	GASKET; 6-hole; 2 used
	32-84180G02	GASKET; 4-hole; 2 used

68P81033E42-A
8/15/77-NPC

TATION" OUTDOOR CABINET

Option C27 (for "Compa-Station" Base Radios)

MODEL	SUFFIX	DESCRIPTION
THN6142A		46" Cabinet (vented for continuous duty only)
THN6303A		46" Cabinet (sealed for intermittent duty only)
TLN4862A		Outdoor Vent Kit
TRN6448A		Cabinet Hardware Kit

FEATURES

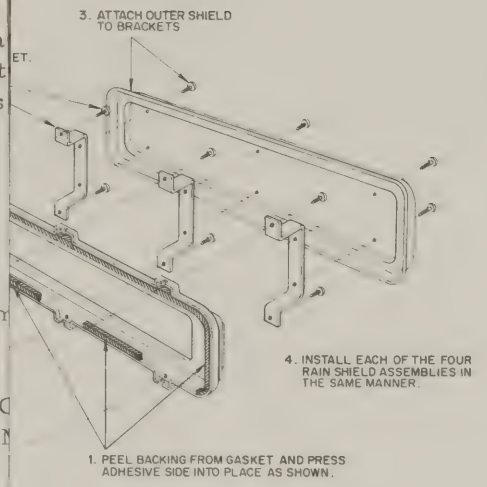
-- Water drainage holes
-- Rust resistant equipment mou
-- Thick door gaskets
-- Screw and flange type door la
-- Vent seal for intermittent dut
-- Vent kit for continuous duty s
-- Sealed cabinet corner joints

CABINET INSTALLATION

-- Mount on elevated support or
-- Shady or cool area if possible
-- Minimum of eight inches from

CAUTION

LOOSEN BOTH DOOR LATC
OPENING CABINET OR DAM
DOOR MAY RESULT.


3. ATTACH OUTER SHIELD TO BRACKETS
4. INSTALL EACH OF THE FOUR RAIN SHIELD ASSEMBLIES IN THE SAME MANNER.
1. PEEL BACKING FROM GASKET AND PRESS ADHESIVE SIDE INTO PLACE AS SHOWN.

FERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

RTS LIST

4862A Outdoor Vent Kit PL-1797-A

	15-84188D01	COVER, outdoor vent (No. 1); 4 req'd
	15-84189D01	COVER, outdoor vent (No. 2); 4 req'd
	32-84452D01	GASKET: 4 req'd
	32-84452D02	GASKET: 8 req'd
	7-84187D01	BRACKET, vent cover: 12 req'd
	4-490775	FLATWASHER: 24 req'd
	4-9795	LOCKWASHER: 24 req'd
	3-138674	SCREW, machine: 6-32 x 11/16" 24 req'd
	3-138209	SCREW, tapping: 6-32 x 3/8" 24 req'd
	2-7005	NUT, hex: 6-32 x 1/4"; 24 req'd

"COMPA-STATION" OUTDOOR CABINET

Option C27 (for "Compa-Station" Base Radios)

MODEL	SUFFIX	DESCRIPTION
THN6142A		46" Cabinet (vented for continuous duty only)
THN6303A		46" Cabinet (sealed for intermittent duty only)
TLN4862A		Outdoor Vent Kit
TRN6448A		Cabinet Hardware Kit

FEATURES

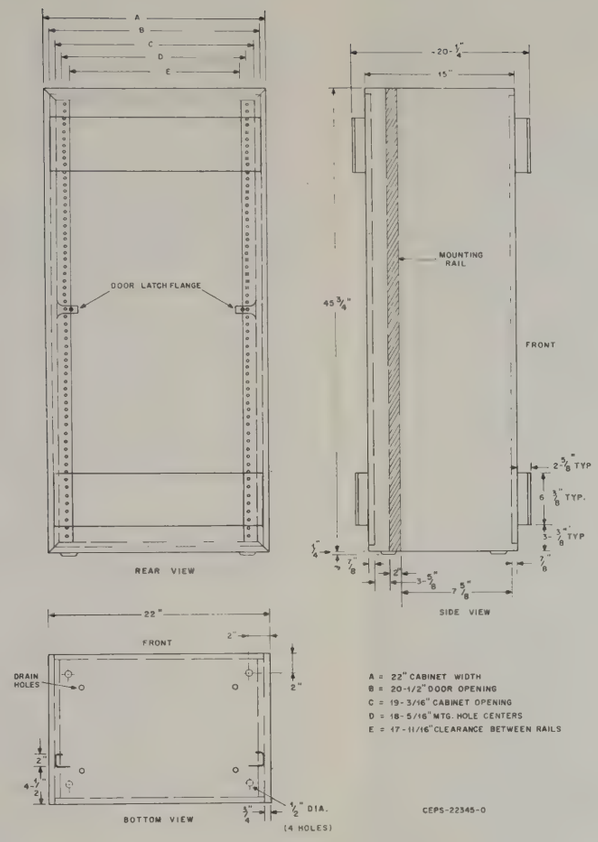
-- Water drainage holes
-- Rust resistant equipment mounting rails
-- Thick door gaskets
-- Screw and flange type door latches
-- Vent seal for intermittent duty stations
-- Vent kit for continuous duty stations
-- Sealed cabinet corner joints

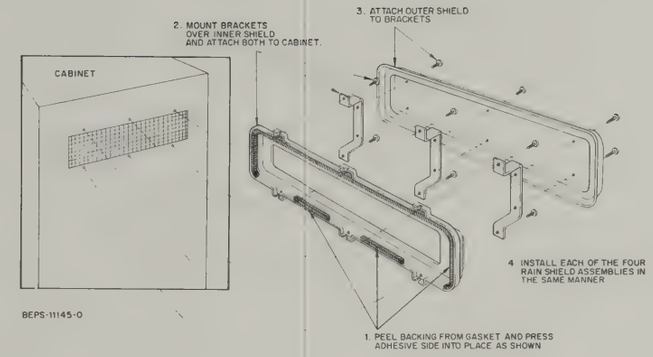
CABINET INSTALLATION

-- Mount on elevated support or platform
-- Shady or cool area if possible
-- Minimum of eight inches from all obstructions

CAUTION

LOOSEN BOTH DOOR LATCHES BEFORE OPENING CABINET OR DAMAGE TO THE DOOR MAY RESULT.




2. MOUNT BRACKETS OVER INNER SHIELD AND ATTACH BOTH TO CABINET.
3. ATTACH OUTER SHIELD TO BRACKETS
CABINET
4. INSTALL EACH OF THE FOUR RAIN SHIELD ASSEMBLIES IN THE SAME MANNER
BEPS-11145-O
1. PEEL BACKING FROM GASKET AND PRESS ADHESIVE SIDE INTO PLACE AS SHOWN

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TRN6448A Cabinet Hardware Kit — PL-3626-O

	2-836540	SPEED NUT (4 req'd.)
	3-135499	SCREW, tapping; 1/4 - 14 x 5/8" (4 req'd.)

THN6303A Sealed 46-Inch Cabinet
(For Intermittent Duty Station) — PL-5105-O

	15-84144D11	CABINET, outdoor

THN6143A Vented 46-Inch Cabinet
(For Continuous Duty Stations) — PL-5104-O

	15-84144D08	CABINET, outdoor

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN4862A Outdoor Vent Kit — PL-1797-A

	15-84188D01	COVER, outdoor vent (No. 1); 4 req'd
	15-84189D01	COVER, outdoor vent (No. 2); 4 req'd
	32-84452D01	GASKET: 4 req'd
	32-84452D02	GASKET: 8 req'd
	7-84187D01	BRACKET, vent cover: 12 req'd
	4-490775	FLATWASHER: 24 req'd
	4-9795	LOCKWASHER: 24 req'd
	3-138674	SCREW, machine: 6-32 x 11/16" 24 req'd
	3-138209	SCREW, tapping: 6-32 x 3/8" 24 req'd
	2-7005	NUT, hex: 6-32 x 1/4"; 24 req'd

68P81033E46-O
1/11/77

1. INTRODUCTION

This section of the manual describes local operation techniques required to perform maintenance checks. Overall station maintenance is detailed in this section while specific chassis maintenance (transmitter, receiver or power supply, etc.) is provided with the applicable section. Maintenance checks for control modules are given with the applicable module in separate Control and Applications Instruction Manual 68P81025E60.

2. LOCAL OPERATION FOR TESTING & MAINTENANCE

NOTE

When ac power to the station is turned on, the transmitter is inhibited by the filament regulator board for approximately 68 seconds. The disable light on the station control module is illuminated during this period.

2.1 Once power is applied and the station is properly adjusted, this base or repeater station is normally operated entirely unattended from a remote control point. However, the station may be locally operated utilizing controls on control modules in the unified chassis. This type of operation may be necessary to accomplish station maintenance and testing.

2.2 Local operation of the station is primarily accomplished utilizing controls on the station control module located in the unified chassis. The controls and function are listed in the table on the following page.

WARNING

The transmitter can be keyed remotely. To prevent unexpected transmitter keying while servicing the station, be sure the LINE DISABLE switch is actuated (direction of arrow). Also, the TLN4662A Squelch Gate Module must be temporarily removed from the remote control chassis if the station is equipped with a TLN4659A DC Transfer Module.

2.3 The following are procedures pertaining to the local operation of a remotely controlled station or repeater station.

2.3.1 Transmitter Control

To prevent the transmitter from being keyed remotely, set station control module LINE DISABLE switch in the direction of the arrow. At conclusion of local operation, insure that the LINE DISABLE switch is returned to its normal position (opposite direction of the arrow).

2.3.2 Local Microphone

2.3.2.1 Stations Without Built-In Metering

Connect a "Micor" microphone (Motorola Model TMN6054A or equivalent) to the microphone receptacle on the unified chassis interconnect board (part of J4, pins 3, 4, 5, 14, 15 and 16).

2.3.2.2 Stations With Built-In Metering

Connect a Motorola Model (TMN6071A) microphone, or equivalent to the MICROPHONE receptacle on the metering chassis.

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

STATION CONTROL MODULE CONTROLS

CONTROL	POSITION	FUNCTIONS POSSIBLE
XMIT	Normal (not actuated)	Normal mode of operation.
	Actuated (hold to right)	Turns on transmitter with no modulation. Use test microphone connected to Local Mic receptacle to modulate transmitter.
"PL" DISABLE* (functional only in "Private-Line" stations)	Normal (left)	Only "PL" tone-coded on-frequency signals accepted by receiver.
	Actuated (right)	All on-frequency signals accepted by receiver.
LINE DISABLE*	Normal (left)	Transmitter can be operated by: 1. XMIT switch 2. Local microphone 3. Remote control console
	Actuated (right)	Transmitter can not be operated by remote control console over control line.

* The DISABLE LIGHT is illuminated when the LINE DISABLE or "PL" DISABLE switch is actuated.

2.3.3 Local Speaker

2.3.3.1 Stations Without Built-In Metering

Connect any 8-ohm, 10-watt test speaker to J4, pins 1 and 12, on the unified chassis interconnect board. This speaker is used to monitor all received messages. A Motorola "Micor" speaker (Models TSN6016A or B, TSN6020A) plugs directly into these pins without requiring any adapter.

2.3.3.2 Stations With Built-In Metering

Place the SPEAKER ON-OFF switch to the ON position.

2.3.4 Portable Test Set (For Stations Without Built-In Metering)

A Motorola S1056-S1059 Series Portable Test Set with TEK-37 or TEK-37A Adapter Cable can be used as a local control facility. Connect the red "control" plug of the adapter cable to the metering receptacle (J3) on the unified chassis interconnect board. The speaker in the test set can be used for monitoring received signals and a "Motrac" microphone (Model TMN6071A) connected to the microphone receptacle on the test set can be used for originating transmissions. The XMIT button on the test set can be used to key the transmitter without voice modulation.

2.3.5 Frequency Selection

For stations with a two-frequency transmitter, the frequency can be locally selected by the F1-F2 switch on the dc transfer module or on the F2 tone decoder module. For stations with a two-frequency receiver, frequency selection is made by momentarily operating the REC F1 SELECT or REC F2 SELECT switch on the dc transfer module or on the F2 tone decoder module.

2.3.6 Selection of Other Modes

All other functions that can be activated by remote control can also be activated locally. Each module has test switches to activate any such functions, such as RPTR ON and RPTR OFF. Most of these switches are momentary action, which allows the station to continue operating in the selected mode until reset.

2.3.7 Received Audio

After the local speaker is turned on or connected, the station is ready to receive audio. The receiver "PL" feature, if used, can be defeated by setting the station control module "PL" DISABLE switch in the direction of the arrow. (At the conclusion of local operation, insure that the "PL" DISABLE switch is returned to its normal position.) If necessary, the receiver can be unsquelched utilizing the receiver SQUELCH control on the receiver chassis. The VOLUME control on the receiver chassis sets the audio output level of the local speaker.

2.3.8 Transmitting

NOTE

Before initiating any local transmissions, monitor the channel to insure that it is clear of other transmissions.

The transmitter is keyed locally by either activating the station control module XMIT switch or activating the push-to-talk microphone switch. Voice is transmitted using the local microphone.

2.3.9 Concluding Local Operation

At the conclusion of local operation, perform the following operations and checks to insure that the station is ready for remote operation.

Step 1. Reset receiver squelch level per procedures in Receiver Section (Audio & Squelch) of this manual.

Step 2. Insure that station control module switches are positioned for normal operation (reference table).

Step 3. Disconnect microphone and test speaker (if used).

Step 4. Set all external power switches ON.

Step 5. Insure that station is operable from remote location.

Step 6. Turn local speaker OFF (if applicable).

Step 7. Disconnect or remove any metering plugs or test set.

Step 8. Insure that cabinet doors are locked.

Step 9. Insure that vents in cabinet are unobstructed.

3. MAINTENANCE TECHNIQUES

3.1 GENERAL

Maintenance procedures for individual chassis which comprise this station are contained in the applicable section of this manual. Module maintenance information is provided in separate manual 68P81025E60. As an aid to isolating a malfunction to a specific chassis or module, a variety of techniques are appropriate.

3.2 TRANSMITTER AND RECEIVER

Most troubles in the transmitter or receiver can be quickly isolated with metering checks. A log of normal meter readings for this station should be maintained. Each time maintenance is performed, the meter readings should be entered into the log. Variations from the previous readings can isolate a malfunction or may indicate an impending failure. If no previous meter readings are available, typical or minimum meter readings may be found with the receiver rf and i-f, exciter, power amplifier or power control board instruction sections, as well as metering procedures.

3.3 POWER SUPPLY

A check of power supply voltages under load and no-load conditions (transmit and standby) should quickly isolate any malfunction.

3.4 REMOTE CONTROL UNIT

Isolation of a malfunction in the control portion of the unified chassis requires a functional understanding of the overall station operation and the inter-relationship between the various modules and chassis of the station. The "Functional Description" section along with the REMOTE CONTROL MODULE DIAGRAMS section of manual 68P81025E60 provide necessary information. With a basic understanding of station operation, troubles may be isolated by analyzing the following questions:

(1) Are all interlocks working normally?

(2) Can the station be operated locally but not remotely? If so, this eliminates many circuits as possible sources of trouble.

(3) How many modes are inoperable? Concentrate testing on circuits that are common to the inoperable modes.

(4) Are adjustments properly set? This includes audio level adjustments at the station and at the remote control point.

(5) Are jumpers properly installed? The many jumpers in this equipment provides vast flexibility, but could be a source of trouble if improperly added, removed, or not removed as the case may be.

4. ROUTINE MAINTENANCE CHECK LIST

ITEM	CHECK
Receiver	Measure the signal level required to obtain 20 dB quieting.
	Compare meter readings with the minimum value and all previous readings taken. Realign the receiver, if necessary.
	For PL stations, check for proper operation of the PL decoder. Does the squelch open when the proper PL tone- or binary-code is detected?
Transmitter	Measure transmitter output power.
	Compare meter readings with the minimum value and all previous readings are taken. Realign the transmitter, if necessary.
	Verify that each transmitter channel is on frequency and adjust if necessary.
	Tune and load the transmitter to the antenna.
	Measure transmitter frequency deviation for both voice and PL coded modulation. Adjust the "IDC" control, if necessary.
	Measure the exciter modulator sensitivity.
	Check the PA blower filters. Cleaning is required once every six months.
System Operation	Measure and adjust the audio input to the exciter.
	Measure and adjust the receiver(s) audio output to the control line.
	Check control line levels and functions for proper operation.
	Adjust receiver(s) on frequency with the distant transmitter(s) in the system.
	Check for proper repeater operation on repeater models.
	Check all accessory equipment for proper operation.
After Performing Maintenance	Check all items listed in the Concluding Local Operation paragraph of this section of the instruction manual.

5. TABLE OF RECOMMENDED TEST EQUIPMENT

TYPE OF EQUIPMENT OR TYPE OF MEASUREMENT	EQUIPMENT CHARACTERISTICS	RECOMMENDED TYPE
Transmitter Frequency Measurement	Frequency - 851-866 MHz Accuracy - ±.00001% or better	Model R1200 Series Service Monitor.
Transmitter Deviation Measurement	Peak reading type for voice or sinusoidal wave; scales for accurate reading of ±5 kHz deviation (and ±1 kHz deviation for "Private-Line" models).	Model R1200 Series Service Monitor.
Transmitter Power Output Measurement	851-866 MHz; 50 ohms; at least 0-250 watts. 50-ohm dummy load; at least 150-200 watts.	Motorola Wattmeter with appropriate element. Motorola Model T-1013A RF Load Resistor.
RF Signal Generator for receiver testing	25 to 960 MHz; FM; high-stability; accurate adjustable output 0 to 1000 microvolts.	Motorola Model R1200 Series Service Monitor. FM signal generator - equiv. to following specs. frequency range - 800 to 960 MHz calibration accuracy - 0.25% stability - ±50 ppm over 15 min. period after 15 min. warmup.
Audio Voltage Measurements RF Millivoltmeter	High impedance (10 megohm); dBm scale. Accurate high frequency (up to 800 MHz) voltage measurements at the millivolt level.	Motorola Model S1053 Solid-State AC Voltmeter. Motorola S1339 Analog or S1340 Digital with a 50 ohm BNC adapter tip.

TYPE OF EQUIPMENT OR TYPE OF MEASUREMENT	EQUIPMENT CHARACTERISTICS	RECOMMENDED TYPE
Audio Signal Generator for audio circuit testing in receiver and transmitter.	Variable amplitude 0 to 1 volt; 1000 Hz tone (300 to 3000 Hz preferred); sinusoidal wave.	Motorola Model S1067 Solid-State Audio Oscillator. Motorola Model TEK-1 Tone Oscillator. Motorola Model R1200 Series Service Monitor.
DC Voltage Measurements, Resistance Measurements, RF Voltage Measurements.	High impedance (11 megohm) dc multimeter.	Motorola S1063 Solid-State DC Multimeter with SLN6055A RF Probe below 400 MHz; Motorola S1339 RF Millivoltmeter above 400 MHz. Motorola Model R1001 Digital Multimeter.
Waveform Measurements	Oscilloscope: Audio Circuit measurements. RF circuit measurements, at least 50 MHz bandwidth.	Any general purpose oscilloscope. A high quality instrument is required.
Contact Removal Tool	Used to remove female wire terminals from metering cable connector.	Motorola part number 66B84690C01.

6. ALIGNMENT

The following paragraphs contain comple transmitter alignment procedures. For con- venience, this information is also contained i the applicable section. Refer to section 68P81031E62 for receiver alignment.

NOTE

Before initiating alignment procedures, insure that the filament voltage is properly adjusted (refer to section 68P81031E53).

6.1 EXCITER ALIGNMENT

6.1.1 Excerpts From FCC Regulations

FCC Regulations state that:

1. Radio transmitters may be tuned or adju only by persons holding a first or second class commercial radiotelephone operato license or by personnel working directly under their immediate supervision.

2. The power input to the final radio freque stage shall not exceed the maximum figu specified on the current station authoriza This power input shall be measured and results recorded:

   a. When the transmitter is initially in stalled.
   b When any change is made in the tra mitter which may increase the pow input.
   c. At intervals not to exceed one year

3. Frequency and deviation of a transmitter must be checked:

   a. When it is initially installed.
   b. When any change is made in the tra mitter which may affect the carrier frequency or modulation characteri tics.
   c. At intervals not to exceed one year.

6.1.2 Local Transmitter Keying

NOTE

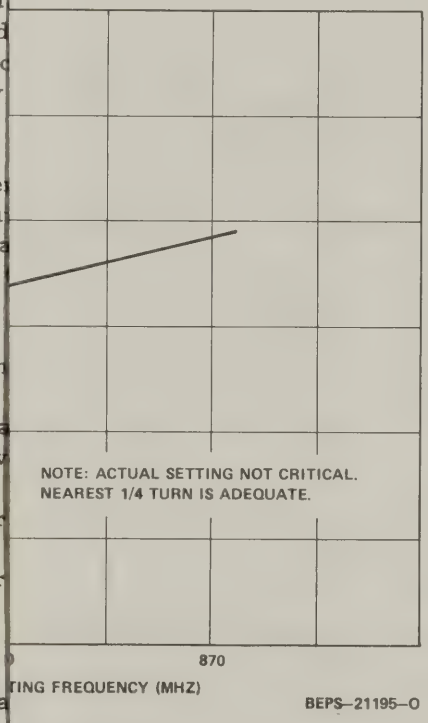
Before initiating any local transmissions monitor the channel to insure that it is clear of other transmissions.

The transmitter is keyed locally by either activating the station control module

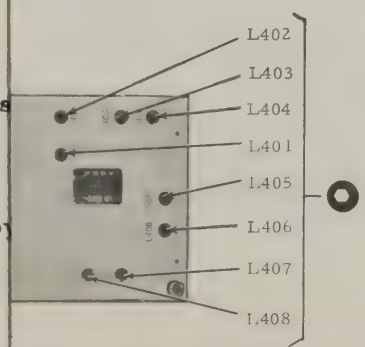
	OFF REF A	EXCITER OUTPUT - Tune L408 and then L407 for peak meter read- ing.
		Repeat steps 6, 8 and 10.
		"Power Set" the power amplifier.

)TE

ional built-in metering (if so equipped) or by Portable Test Set. All meter readings are tance in the meter. Therefore, meters not ave their readings corrected. The following over all three cases. The OSC. & METER st set usage -- polarity is automatically re- s used.



eset for Exciter Coils



djustment Locations

6. ALIGNMENT

The following paragraphs contain complete transmitter alignment procedures. For convenience, this information is also contained in the applicable section. Refer to section 68P81031E62 for receiver alignment.

NOTE

Before initiating alignment procedures, insure that the filament voltage is properly adjusted (refer to section 68P81031E53).

6.1 EXCITER ALIGNMENT

6.1.1 Excerpts From FCC Regulations

FCC Regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a first or second class commercial radiotelephone operator's license or by personnel working directly under their immediate supervision.

2. The power input to the final radio frequency stage shall not exceed the maximum figure specified on the current station authorization. This power input shall be measured and the results recorded:

   a. When the transmitter is initially installed.
   b. When any change is made in the transmitter which may increase the power input.
   c. At intervals not to exceed one year.

3. Frequency and deviation of a transmitter must be checked:

   a. When it is initially installed.
   b. When any change is made in the transmitter which may affect the carrier frequency or modulation characteristics.
   c. At intervals not to exceed one year.

6.1.2 Local Transmitter Keying

NOTE

Before initiating any local transmissions, monitor the channel to insure that it is clear of other transmissions.

The transmitter is keyed locally by either activating the station control module XMIT switch or activating the push-to-talk microphone switch. Voice is transmitted using the local microphone.

6.1.3 Frequency Calculations

$$f_o = \frac{f_e}{12} \quad (141.8\text{-}144.3 \text{ MHz})$$

Where: f_o = oscillator frequency

f_e = exciter output frequency

6.1.4 Transmit Oscillator Frequency Adjustment

6.1.4.1 The transmitter oscillator is a high stability, ovenized unit employing a warp capacitor for fine frequency adjustment. The unit is mounted on the TRN6573A Oscillator Mounting Kit which provides connections to the exciter modulating circuitry.

6.1.4.2 Perform transmit frequency adjustments as follows:

Step 1. Apply power to the station for 15 minutes to allow the oscillator oven to stabilize.

Step 2. Couple a frequency counter with a time base of at least 0.1 ppm to the PA output. Attach test equipment as indicated in figure 1.

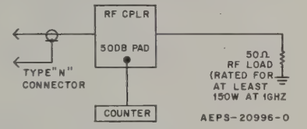


Figure 1. Frequency Adjust Equipment Setup

Step 3. Remove the silver colored plug (labeled FREQ ADJUST) from the end of the oscillator.

Step 4. Using a tuning tool, adjust the screw behind the silver plug until the frequency registered on the counter matches the specified rf carrier frequency.

Step 5. Replace the silver plug and remove all test equipment.

6.1.5 Deviation (IDC) Adjustment

Step 1. It is assumed that the transmit channel has been "warped" on frequency before attempting to adjust the IDC circuit.

Step 2. Connect an audio oscillator to the exciter input (pin 12, accessible from front of station behind exciter cover).

Step 3. Set the audio-oscillator for 1000 Hz @ 1 volt (rms).

Step 4. Key the transmitter and adjust the IDC control for ±5 kHz deviation.

Step 5. Reduce the audio oscillator output to 0.25 volts. Essentially, full deviation should still be indicated. Less than full deviation may indicate weak or inoperative exciter audio stages.

EXCITER ALIGNMENT PROCEDURE

(Refer to preceding Metering Note)

STEP	ADJUST	METERING PLUG INSERTED INTO	SELECTOR SWITCH POSITION	METER REV. SWITCH AND REF A-B SWITCH (SEE NOTE)	STAGE AND PROCEDURE
1					SET UP - Key the transmitter with the XMTR ON pushbutton on the portable test set.
2	POWER SET				OUTPUT - Turn the POWER SET control fully counterclockwise. Unkey the transmitter.
3	FREQUENCY SWITCH	EXCITER	2	OFF REF A	CHANNEL ELEMENT - Select the desired frequency on multi-frequency stations. Key the transmitter. Meter 2 should indicate at least 10 uA.
4	ALL EXCITER COILS	EXCITER	5	OFF REF A	PRE-ALIGNMENT - If the exciter is completely untuned and shows no meter 5 readings, set cores of tuning coils L401 thru L406 to the top of their coil forms (away from circuit board) and preset tuning coils L407 & L408 from circuit board end of coil form per figure 1.
5	L401	EXCITER	2	OFF REF A	BUFFER OUTPUT - Tune L401 for minimum meter reading.
6	L401, L402	EXCITER	3	OFF REF A	BUFFER OUTPUT - Tune L402 and then L401 for peak meter reading.
7	L403	EXCITER	3	OFF REF A	TRIPLER OUTPUT - Tune L403 for minimum meter reading.
8	L403, L404	EXCITER	4	OFF REF A	TRIPLER OUTPUT - Tune L404 and then L403 for peak meter reading.
9	L405	EXCITER	4	OFF REF A	FIRST DOUBLER OUTPUT - Tune L405 for minimum meter reading.
10	L405, L406	EXCITER	5	OFF REF A	FIRST DOUBLER OUTPUT - Tune L406 and then L405 for peak meter reading.
11	L407	EXCITER	5	OFF REF A	EXCITER OUTPUT - Tune L407 for peak meter reading.
12	L407, L408	EXCITER	5	OFF REF A	EXCITER OUTPUT - Tune L408 and then L407 for peak meter reading.
13					Repeat steps 6, 8 and 10.
14					"Power Set" the power amplifier.

NOTE

Metering may be performed using either optional built-in metering (if so equipped) or by using a Motorola S1056B thru S1059B Series Portable Test Set. All meter readings are based on a 2000 ohm equivalent series resistance in the meter. Therefore, meters not having a 2000 ohm series resistance must have their readings corrected. The following Exciter Alignment Procedure is written to cover all three cases. The OSC. & METER REV. SWITCH column refers to portable test set usage -- polarity is automatically reversed as required when built-in metering is used.

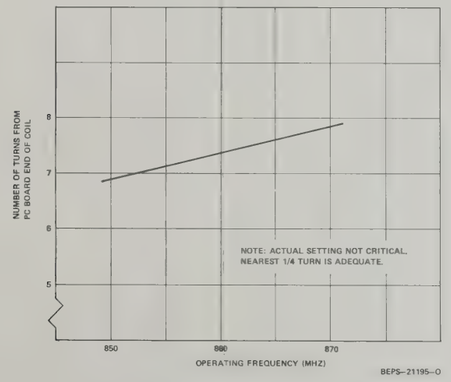


Figure 2. Tuning Preset for Exciter Coils

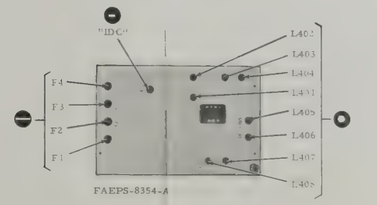


Figure 3. Exciter Adjustment Locations

6.3 FINAL PA ALIGNMENT PROCEDURE

CAUTION

High voltages are present when power is applied to the station.

6.3.1 Preliminary Adjustment

Step 1. Insure that no ac power is applied to the station.

Step 2. Before attempting to align the power amplifier, insure that the exciter, IPA, and low voltage power supply adjustments have been made.

Step 3. Connect a 250 watt wattmeter between the antenna output connector and the antenna.

Step 4. Set station switches as indicated below:

Cathode resistor R900 - Fully counterclockwise

Output Coupling L902 - Adjust so that tuning bar is horizontal to top of cabinet

Step 5. To adjust the tuning range of the amplifier to the 850-860 MHz or 860-870 MHz bands, moveable end plates are provided on each side of the amplifier cavity. Loosen all screws on each end plate until the end walls are hand moveable with the provided handles.

Step 6. The tuning control will fine-tune over a 10 MHz range. The moveable end plates should be pushed toward the tube for the 860-870 MHz band and away from the tube for the 850-860 MHz band. Tighten all screws temporarily.

6.3.2 Tuning Procedure

After making preliminary adjustments, perform the following tuning procedure.

Step 1. Apply power to the station.

CAUTION

1500 V dc is present at the PA plate when power is applied to the station.

After the transmitter is enabled by the transmit inhibit circuitry (see section 68P81031E53), key the station. The plate current should increase and there should be an indication of power output on the 250 watt wattmeter.

Step 2. Adjust the output tuning control for maximum power. The white dot on the output tuning control points in the same direction as the tuning loop. It can be rotated 180° counterclockwise from a position which points to the left side of the cabinet to a position which points toward the tuning label.

Step 3. With the white dot pointing toward the tuning label, rotate clockwise and observe the swing of power output. If the power increases through a maximum and decreases before the white dot has traveled 90°, the moveable end plates are properly set. If more than 90° of rotation is necessary to accomplish a power increase and decrease, loosen the end plates and move them toward the tube. Conversely, should power decrease immediately, move the end plates slightly away from the tube. Continue this procedure so that tuning maximum occurs between 45° and 60° of rotation. Tighten all screws after each adjustment.

Step 4. Output coupling control L902 must be set for maximum power output. First, loosen the locknut so that the coupling may be adjusted smoothly. While watching the power output meter and insuring that the tuning control is in resonance, turn the output coupling loop to the point of maximum power output. On each adjustment, check the tuning control for maximum power. When optimum coupling (maximum power) is found, lock the output coupler in place. Adjust R900 clockwise for required power, NOT to exceed allowed power output (refer to figure 4). Plate current should not exceed 300 mA.

Step 5. The input circuit should now be adjusted. Input tuning and matching must be accomplished under full power conditions. The input is matched by minimizing the reflected power in the drive line. Reflected power is indicated on power control board meter position 2. Loosen the locknut on the input coupling probe so that the probe may be moved axially with finger pressure. Loosen the input tuning vernier lock. The probe should then be moved in and out and the input tuning vernier adjusted for minimum reflected power. The preceding adjustments are interacting. Therefore, repeat the preceding procedure until stable settings are obtained and lock the input tuning vernier and input coupling control. Re-peak the output tuning controls. The output power control should then be adjusted for the desired power output using R900. Repeak output tuning after each adjustment. Minimize reflected power if necessary.

6.2 IPA POWER SETTING PROCEDURE

NOTE

If the transmitter is to be brought back up to rated power after turning down the POWER SET control for alignment or troubleshooting procedure, proceed directly to step 4.

NOTE (cont'd.)

STEP	ADJUST	METERING PLUG LOCATION	TEST SET SELECTOR SWITCH POSITION	METER REV. SWITCH & REF. A-B SWITCH	STAGE AND PROCEDURE
1	Power Set and Drive	Power Control Board	Watt meter		Pre-Setting of Controls: Adjust the drive limit control fully counterclockwise (maximum drive). Adjust the Power Set Control fully clockwise (near maximum power output). Connect a wattmeter and load to the directional coupler rf output connector and remove the shielf from over the power control board.
2	Drive Limit	Power Control Board	Watt-meter		Key Transmitter. Adjust drive limit (R609 on power control board) until a power output of 17 watts is obtained. If power output is less than 17 watts, see IPA, and power control board maintenance sections. Unkey the transmitter and replace shield.
3	Power Set	Power Control	Watt-meter		Key the transmitter. Adjust the power set control (R607 on power control board) until power output is within the station licensing parameters (see figure 1). Unkey the transmitter. On multi-frequency radios, check drive limit on both channels. If necessary, readjust Drive Limit control so the lowest power channel is set to 1 17 watts. If the Drive Limit control cannot obtain a high enough reading, set it fully counterclockwise (minimum drive limit). Unkey transmitter.
4	Power Set	Power Control Board	Watt-meter		Power Set: Key transmitter. Adjust the Power Set control CCW and set power output per Table 3 under Power Set. On multi-frequency radios, check power output on all channels. If necessary, readjust Power Set so the lowest power channel is set per Table 3 under Power Set. Unkey transmitter. This completes the IPA power setting procedure.
5	Filament Voltage	P. A.	Volt-meter		Verify standby filament voltage of 6.3 V DC. Key exciter - IPA and verify that filament voltage drops to 5.0 V DC. Readjust as necessary with controls located on the power supply regulator board.

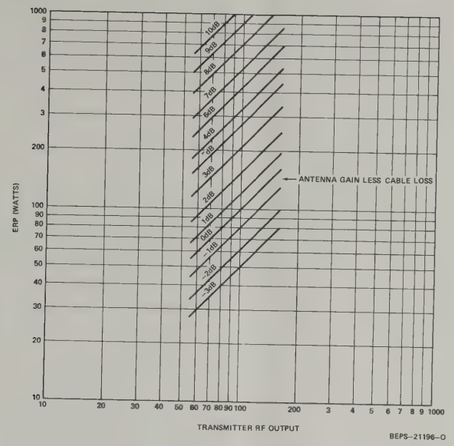


Figure 4. Effective Radiated Power

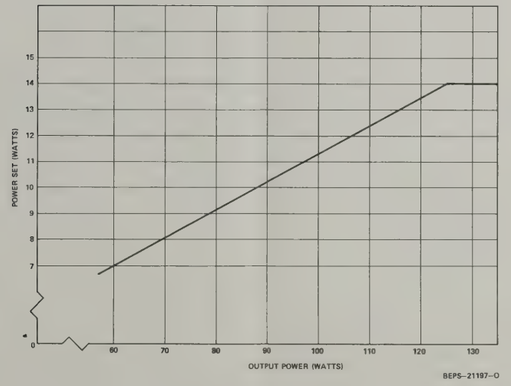


Figure 5. IPA Power Output

6.3 FINAL PA ALIGNMENT PROCEDURE

CAUTION

High voltages are present when power is applied to the station.

6.3.1 Preliminary Adjustment

Step 1. Insure that no ac power is applied to the station.

Step 2. Before attempting to align the power amplifier, insure that the exciter, IPA, and low voltage power supply adjustments have been made.

Step 3. Connect a 250 watt wattmeter between the antenna output connector and the antenna.

Step 4. Set station switches as indicated below:

Cathode resistor R900 - Fully counterclockwise

Output Coupling L902 - Adjust so that tuning bar is horizontal to top of cabinet

Step 5. To adjust the tuning range of the amplifier to the 850-860 MHz or 860-870 MHz bands, moveable end plates are provided on each side of the amplifier cavity. Loosen all screws on each end plate until the end walls are hand moveable with the provided handles.

Step 6. The tuning control will fine-tune over a 10 MHz range. The moveable end plates should be pushed toward the tube for the 860-870 MHz band and away from the tube for the 850-860 MHz band. Tighten all screws temporarily.

6.3.2 Tuning Procedure

After making preliminary adjustments, perform the following tuning procedure.

Step 1. Apply power to the station.

CAUTION

1500 V dc is present at the PA plate when power is applied to the station.

After the transmitter is enabled by the transmit inhibit circuitry (see section 68P81031E53), key the station. The plate current should increase and there should be an indication of power output on the 250 watt wattmeter.

Step 2. Adjust the output tuning control for maximum power. The white dot on the output tuning control points in the same direction as the tuning loop. It can be rotated 180° counterclockwise from a position which points to the left side of the cabinet to a position which points toward the tuning label.

Step 3. With the white dot pointing toward the tuning label, rotate clockwise and observe the swing of power output. If the power increases through a maximum and decreases before the white dot has traveled 90°, the moveable end plates are properly set. If more than 90° of rotation is necessary to accomplish a power increase and decrease, loosen the end plates and move them toward the tube. Conversely, should power decrease immediately, move the end plates slightly away from the tube. Continue this procedure so that tuning maximum occurs between 45° and 60° of rotation. Tighten all screws after each adjustment.

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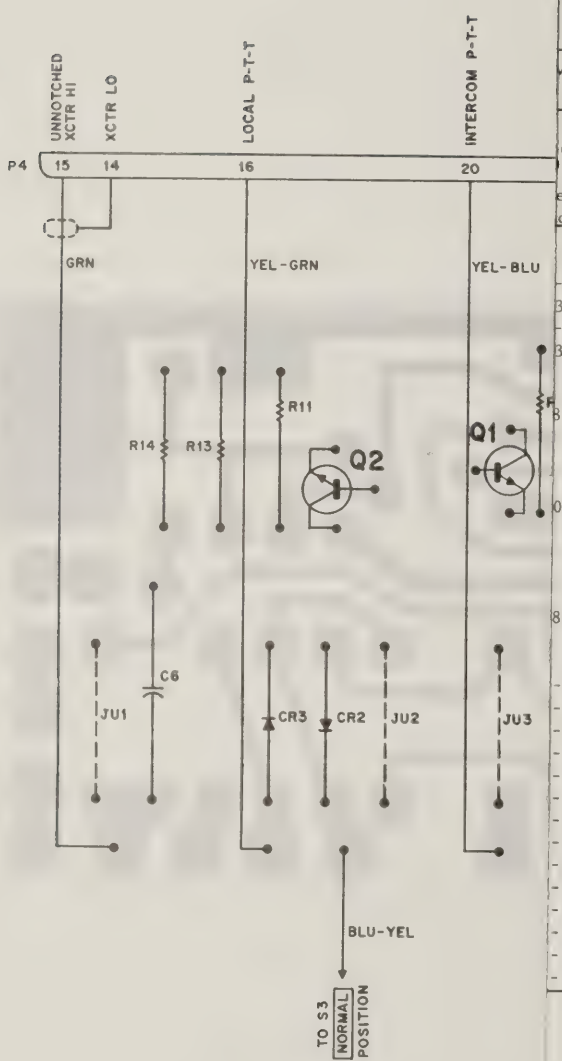
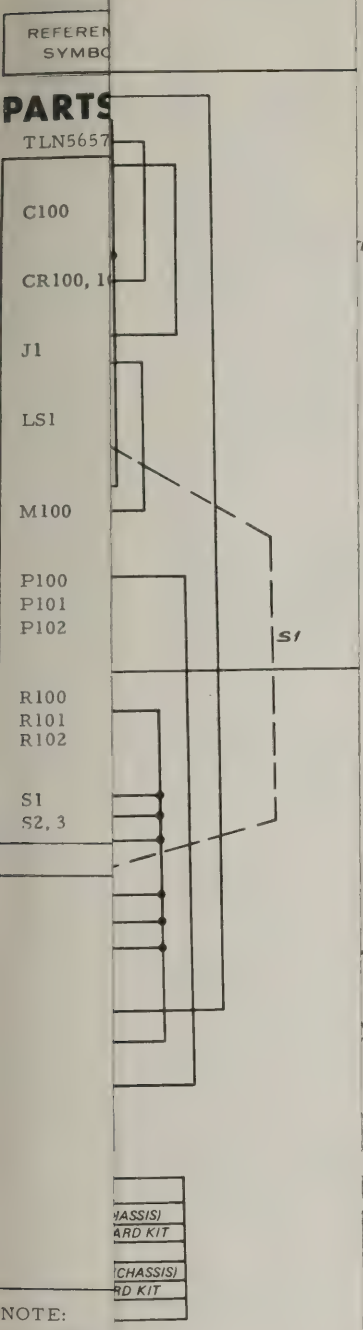
Step 5. The input circuit should now be adjusted. Input tuning and matching must be accomplished under full power conditions. The input is matched by minimizing the reflected power in the drive line. Reflected power is indicated on power control board meter position 2. Loosen the locknut on the input coupling probe so that the probe may be moved axially with finger pressure. Loosen the input tuning vernier lock. The probe should then be moved in and out and the input tuning vernier adjusted for minimum reflected power. The preceding adjustments are interacting. Therefore, repeat the preceding procedure until stable settings are obtained and lock the input tuning vernier and input coupling control. Re-peak the output tuning controls. The output power control should then be adjusted for the desired power output using R900. Repeak output tuning after each adjustment. Minimize reflected power if necessary.

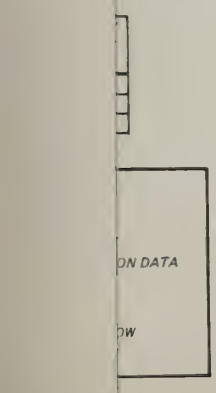
METERING & INTERCOM



	MOTOROLA PART NO.	DESCRIPTION
		T
		er Chassis & Intercom Kit
		om Board PL-2156-C
		CAPACITOR, fixed: uF:
C1	-82905G11	0.22 ±10%; 50 V
C2	3-865137	4.7 ±20%; 25 V
C3	-82905G11	0.22 ±10%; 50 V
C4	3-865137	4.7 ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode:
CR1	8-83654H01	silicon
		SWITCH, magnetic reed:
S3	0-84157B02	13.4 V dc dual-coil; 2 form "A", 1 form "B"; resistance of each coil 285 ohms ±10%
		TRANSISTOR:
Q1	8-869642	NPN; type M9642
		RESISTOR, fixed: ±10%; 1/4 W:
R1	-124C69	6.8k
R2	-124C51	1.2k
R3	-124C53	1.5k
R4	-124C43	560
R5	-124C49	1k
R6	-124C69	6.8k
R7	-124C83	27k
R8	-124C93	68k
R9	-124C43	560
R10	-124C19	56
R11	-124C85	33k
R12	-124C75	12k
R13	-124C49	1k
R14	-124C45	680

PEPS-17760-D
(Sheet 1 of 3)
8/15/77-NPC





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ON-THE-AIR"
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"COMPA-STATION" METERING & INTERCOM

MODEL TLN1740A

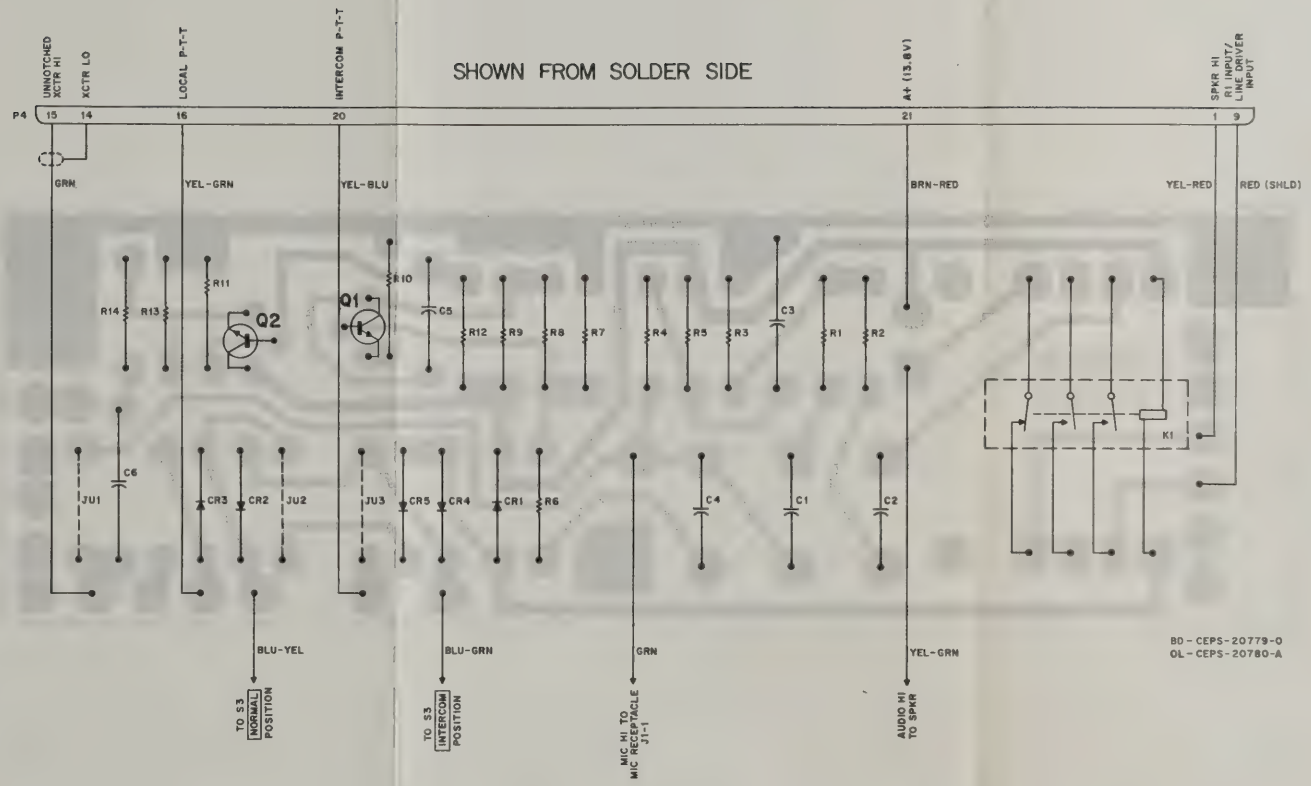
INTERCOM

MODEL TLN1745A

FUNCTION

--Model TLN1740A provides built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.

--Model TLN1745A provides intercom between the station and the remote control point.



REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

TLN1552A Meter Chassis & Intercom Kit
TLN5167A Intercom Board PL-2156-C

		CAPACITOR, fixed: uF:
C1,2	8-82905G11	0.22 ±10%, 50 V
C3	23-865137	4.7 ±20%, 25 V
C4,5	8-82905G11	0.22 ±10%, 50 V
C6	23-865137	4.7 ±20%, 25 V
		SEMICONDUCTOR DEVICE, diode
CR1 thru 5	48-83b54H01	silicon
		SWITCH, magnetic reed: 13.4 V dc
K1	80-84157B02	dual-coil; 2 form "A", 1 form "B"; resistance of each coil 285 ohms ±10%
		TRANSISTOR:
Q1,2	48-869642	NPN; type M9642
		RESISTOR, fixed ±10%, 1/4 W.
R1	6-124C69	6.8k
R2	6-124C51	1.2k
R3	6-124C53	1.5k
R4	6-124C43	560
R5	6-124C49	1k
R6	6-124C69	6.8k
R7	6-124C83	27k
R8	6-124C93	68k
R9	6-124C43	560
R10	6-124C19	56
R11	6-124C85	33k
R12	6-124C75	12k
R13	6-124C49	1k
R14	6-124C45	680

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

TKN6380A Meter Kit PL-3415-A

C1	21-82428B24	CAPACITOR, fixed: .01 uF +80-20% 500 V
CR1	48-82420C03	DIODE: (SEE NOTE) silicon
J1	9-830818	CONNECTOR, receptacle: 4-contact
LS1	50-84710G01	LOUDSPEAKER, permanent: dynamic type; 3", square 16 ohms voice coil impedance
M1	72-83120C02	METER, dc: scale: 0-50 microamperes
P102	29-82676C01	CONNECTOR, plug: test probe: BLACK
P103	29-82676C02	test probe: RED
P104	28-84208B01	7-contacts
R1	6-84640C61	RESISTOR, fixed: 499k ±0.5%; 1/4 W
R2	6-13756D88	100k ±1%; 1/2 W
R3	6-124A33	220 ohm ±5%; 1/4 W
S1	40-83158C01	SWITCH: rotary; 2 section
S2	40-83890A01	slide; dpdt

NON-REFERENCED ITEMS

	5-483208	GROMMET
	35-84930G01	GRILLE, speaker
	36-84356C01	KNOB, control
	42-10217A02	STRAP, cable; 4 req'd.
	42-82143C02	CLAMP, cable
	15-83947K01	COVER; 2 req'd. (used with P102)
	30-83678K01	CABLE, 7-conductor; 42" long (used with P102)
	42-83948K01	CLIP; 2 req'd. (used with P102)
	27-83008K01	CHASSIS, meter
	11-490181	TERMINAL STRIP, 1-lug
	42-87184	CLIP, probe; 3 req'd.
	15-83009K01	COVER, meter
	42-83123F01	RETAINER, nylon; 2 req'd.
	75-83882	BUMPER, rubber; 4 req'd.

Maximum performance, replacement diodes must be ordered by Motorola part number.

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

TLN6194A Interconnect Chassis Kit PL-3452-O

J1	9-830818	CONNECTOR, receptacle: 4-contact
LS1	50-84710G01	SPEAKER 3"; 16 ohm
S2, 3	40-83889	SWITCH, slide: SPST

NON-REFERENCED ITEMS

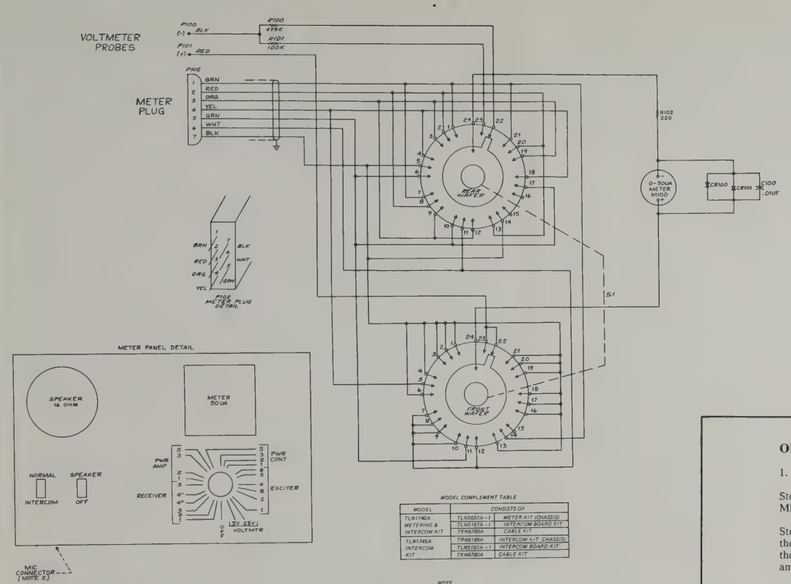
	1-80775B59	CHASSIS (riveted) incl. ref. item 52 and 53
	1-80775B51	COVER ASSEMBLY
	2-13261b	LOCKNUT, speaker (No. 6-32) 4 req'd.
	2-83896G01	NUT, hex (used with J1)
	4-7099	LOCKWASHER (used with J1)
	5-483208	GROMMET, rubber
	35-84530C01	GRILLE, speaker
	42-82143C02	CLAMP, cable (1/4")
	42-10217A02	TY-WRAP, cable; 4 req'd.
	3-13416b	SCREW, machine; No. 4-40 x 1/4"; 7 req'd.
	3-129498	SCREW, machine; No. 6-32 x 5/16"; 4 req'd.
	29-115147	LUG, solder (No. 5)

TKN6380A Cable Kit PL-3418-A

P4	-	CONNECTOR: includes:
	9-84151B03	CONTACT, receptacle; 10 req'd
	14-84556B02	HOUSING

NON-REFERENCED ITEM

	42-10217A02	STRAP, cable harness; 7 used



MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF	
TLN1740A METERING & INTERCOM KIT	TLN6387A-1	METER KIT (CHASSIS)
	TLN6192A-1	INTERCOM BOARD KIT
	TPN6780A	CABLE KIT
TLN1745A INTERCOM KIT	TPN6189A	INTERCOM KIT CHASSIS
	TLN6192A-1	INTERCOM BOARD KIT
	TPN6780A	CABLE KIT

NOTE
WITH 12 W STATIONS, FINAL PA CURRENT IS METERED AT PWR CONT MTR 5. WITH ALL OTHER STATIONS, FINAL PA CURRENT IS METERED AT PA MTR 3

NOTE
1. THIS OPTION REQUIRES THE USE OF A MOTOROLA MODEL TMN8031A MICROPHONE, OR EQUIVALENT

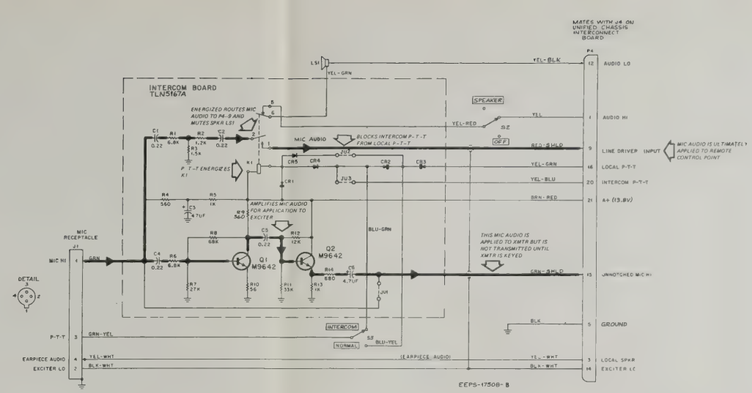
JUMPER TABLE

JUMPER	NORMAL	WHEN "SPECTRA TAC" IS ADDED (OUT CRD)
J1/1	OUT	OUT
J1/2	OUT	IN
J1/3	OUT	IN

LEGEND
THEORY OF OPERATION DATA
PRIMARY SIGNAL FLOW

METER SELECT TABLE

P103 METERING PLUG CONNECTED TO	METER SELECTOR SW MTR NO.	POSITION	FUNCTION METERED
RCVR PC B/D	RECEIVER	1	1	CHANNEL ELEMENT OUTPUT (3RD HARMONIC)
		2	2	1ST DOUBLER OUTPUT
		3	3	2ND DOUBLER OUTPUT
		4 (+)	4	DISCRIMINATOR OUTPUT
		4 (-)	5	DISCRIMINATOR OUTPUT
		5	6	MIC INPUT CURRENT
POWER AMPLIFIER	PWR AMP	1	7	AMP DRIVER CURRENT
		2	8	25 W DRIVER CURRENT (25 W MODEL ONLY)
		3	9	FINAL AMPLIFIER CURRENT (ACCEPT 12 W STATION)
		4	10	CONTROLLED (ADJ.) STAGE VOLTAGE
		5	11	FINAL AMPLIFIER CURRENT (12 W STATIONS ONLY)
POWER CONTROL BOARD	PWR CONT	1	12	ADJ. VOLTAGE
		2	13	REFLECTED POWER
		3	14	FORWARD POWER
		---	15	UNUSED
EXCITER	EXCITER	6	16	UNUSED
		5	17	EXCITER OUTPUT
		4	18	DOUBLER INPUT
		3	19	TRIPLER INPUT
		2	20	CHANNEL ELEMENT OUTPUT
		1	21	VCC AUDIO OUTPUT
---	---	---	22	25 VOLTS FULL SCALE (NOTE METER IS
---	---	---	23	5 VOLTS FULL SCALE LABELLED 0-50)
---	---	---	24	OFF



EEPS-17508-B

"COMPA-STATION" METERING & INTERCOM
MODEL TLN1740A
INTERCOM
MODEL TLN1745A

FUNCTION

--Model TLN1740A provides built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.

--Model TLN1745A provides intercom between the station and the remote control point.

OPERATING INSTRUCTIONS

1. METERING

Step 1. Select the function to be metered with the METER switch.

Step 2. Select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board or the power amplifier.

NOTE

Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used.

Step 3. For receiver discriminator adjustment, use both 4(+) and 4(—) and adjust for meter zero.

Step 4. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 5. To measure miscellaneous station voltages, use the voltmeter probes (P100 and P101) on either the 5 V or 25 V positions. Divide the 5 V full scale reading by 10 to obtain actual voltage and divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER-OFF switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the NORMAL position.

Step 4. The unit is now ready for "ON-THE-AIR" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER-OFF switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER-OFF switch in the SPEAKER position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

PARTS LIST

TLN5656A Metering Kit — PL-3416-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		DIODE: (SEE NOTE)
CR1	48-82392B03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		TRANSISTOR: (SEE NOTE)
Q1	48-869571	PNP; type M9571
		CONNECTOR, plug:
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contact
		RESISTOR, fixed: ±10%; 1/2 W unless otherwise stated
R1		NOT USED
R2	17-82177B04	5; 5 W
R3	6-124A33	220
R4, 10	6-84640C61	499k ±1%
R5	6-125C17	47
R6	6-124A77	15k ±5%; 1/4 W
R7	6-124A57	2.2k ±5%; 1/4 W
R8	6-125C15	39
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt
NON-REFERENCED ITEMS		
	42-890499	CLAMP, cable; 1/2"
	36-82630H01	KNOB, control
	31-490181	TERMINAL STRIP, 1-lug; 2 req'd.
	42-871184	CLIP, probe; 3 req'd.
	30-83678K01	CABLE, 7-conductor; 57" long (used with P102)
	15-83947K01	COVER; 2 req'd. (used with P102)
	42-83948K01	CLAMP, cable; 2 req'd.
	31-835961	TERMINAL BOARD, 18-lug
	27-83400K01	CHASSIS

NOTE:
For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

TKN6782A Cable Kit — PL-3417-C

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
P4	-	CONNECTOR: includes
	9-84151B03	CONTACT, receptacle; 12 req'd.
	14-84556B02	HOUSING

TLN5134A Meter Panel — PL-2233-

		LIGHT, indicator:
DS1	65-83183G02	includes lamp and GRN lens
DS2	65-83183G04	includes lamp and RED lens
		LOUDSPEAKER, permanent magnet:
LS1	50-83562A01	dynamic type; 4"; square; 4 ohms voice coil impedance
		METER, electrical: 50 uA movements:
M1	72-84864B10	scale: 0-25 volts/amps
M2	72-84864B09	scale: 0-50 microamperes
NON-REFERENCED ITEMS		
	13-84616G01	GRILLE, speaker
	13-83207F01	CLOTH, speaker grille
	42-83112A01	CLIP, indicator light retaining; 2 used
	2-7009	NUT, hex: 10-32 x 3/8 x 1/8"; 4 used
	3-119916	SCREW, machine: 10-32 x 7/16" 4 used
	3-131964	SCREW, tapping: 6-32 x 3/8; 12 used
	4-7658	WASHER, lock: #10 (split); 4 used
	7-84620G01	FRAME, top
	7-84620G03	FRAME, bottom
	7-84620G05	FRAME, end: 2 used
	13-83054C10	GRILLE, meter panel
	64-83152C03	PANEL, meter

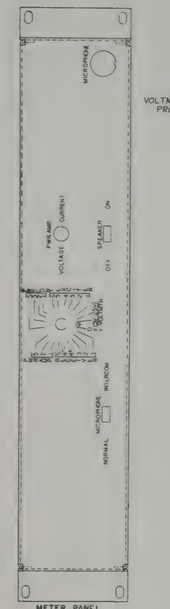
UPRIGHT STATION METERING & INTERCOM

MODELS TLN1739A AND TLN5134A

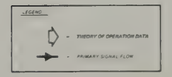
[redacted]

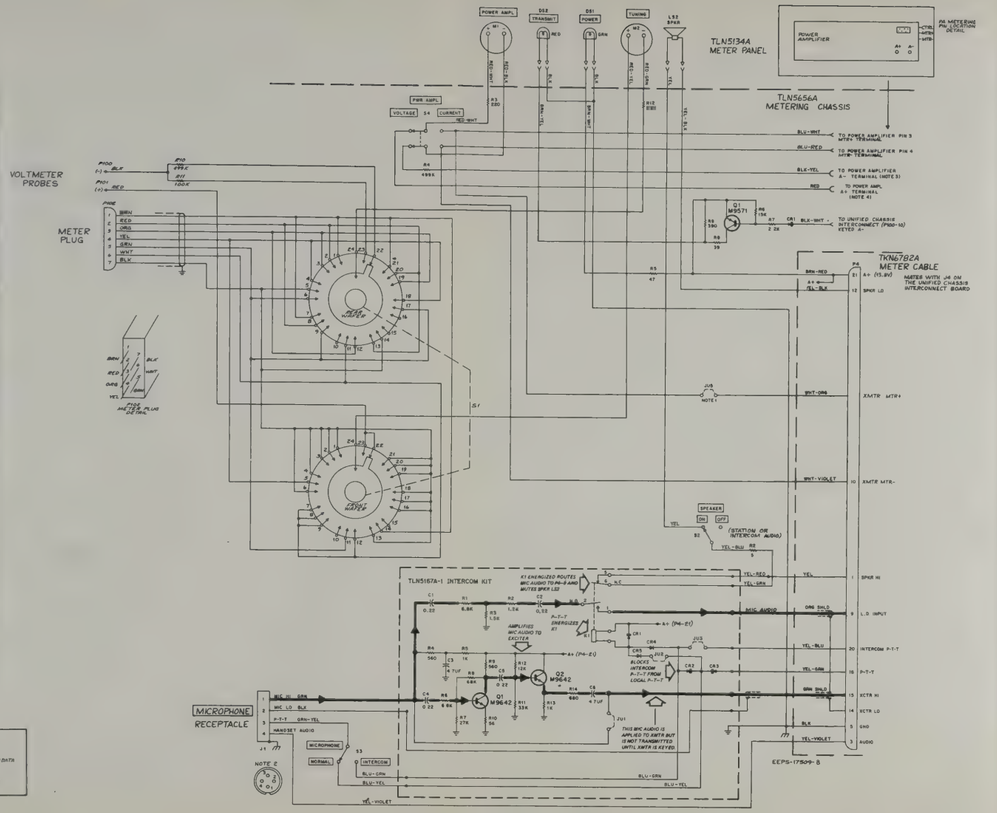
FUNCTION

Provides built-in metering of over 20 major test points in the transmitter and receiver(s). Plus intercom between the station and the remote control point.



METER PANEL DETAIL





PEPS-17760-D
(Sheet 3 of 3)
8/15/77-NPC

OPERATING INSTRUCTIONS

1. METERING

Step 1. Tuning Meter Usage -- Select the function to be metered with the meter switch. Next, select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board, or the power amplifier. NOTE: Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used. For receiver discriminator adjustment, use both 4(+) and 4(—) and adjust for meter zero.

Step 2. PWR AMP Meter Usage -- Select PA current/voltage monitoring by placing the VOLTAGE/CURRENT switch in the applicable position.

Step 3. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 4. Voltmeter Usage -- Use either the 5 V or 25 V scales as applicable. Divide the 5 V full scale reading by 10 to obtain actual voltage. Divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM. in the NORMAL position.

Step 4. The unit is now ready for "on-the-air" testing. If the micrphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER switch in the ON position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF
TLN1739A METERING CHASSIS	TLN5656A METERING CHASSIS
TLN5134A METER PANEL	TLN5653A INTERCOM BOARD KIT
	TKN6782A CABLE KIT

METER SELECT TABLE

P102 METERING PLUG CONNECTED TO	METER SELECTOR SW		FUNCTION METERED
	MTR NO	POSITION	
RCVR RF & IF BOARD	RECEIVER	1	CHANNEL ELEMENT OUTPUT (3RD HARMONIC)
		2	1ST DOUBLER OUTPUT
		3	2ND DOUBLER OUTPUT
		4 (+)	DISCRIMINATOR OUTPUT
		4 (-)	DISCRIMINATOR OUTPUT
		5	LIMITER OUTPUT
POWER AMPLIFIER	PA	6	PA REVERSE POWER
		7	PA REVERSE CURRENT (TLN M MODEL ONLY)
		8	CONTROLLED MULTIPLIER VOLTAGE
		9	FINAL
POWER CONTROL BOARD	PWR CONT	10	FINAL AMP. FILTER CURRENT (12 B STATION ONLY)
		11	ADJ. VOLTAGE
		12	FORWARD POWER
		13	REFLECTED POWER
		14	VSWR
EXCITER	EXCTR	15	LIMITER
		16	EXCITER OUTPUT
		17	DOUBLER OUT
		18	TRIPLER INPUT
		19	CHANNEL ELEMENT OUTPUT
		20	"SYNC" AUDIO OUTPUT
—	—	21	5-VOLT FULL SCALE METER IS
—	—	22	25-VOLT FULL SCALE CALIBRATED
—	—	23	OFF

NOTES

1. J1A -- W1 FOR 13 W MODELS OUT FOR ALL OTHER MODELS
2. INTERCOM REQUIRES THE USE OF A MOTOROLA MODEL TKN6781A MICROPHONE OR EQUIVALENT
3. ON 13-WATT STATIONS BLK-YEL AT I-LEAD IS CONNECTED TO TB2-3 (-) ON UNIFIED CHASSIS INTERCONNECT BOARD
4. ON 13-WATT STATIONS RED AT I-LEAD IS CONNECTED TO TB2-1 (+) ON UNIFIED CHASSIS INTERCONNECT BOARD

PARTS LIST

TLN5656A Metering Kit PL-3416-A

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
CR1	48-82392B03	DIODE: (SEE NOTE) silicon
J1	9-830418	CONNECTOR, receptacle: 4-contact
Q1	48-869571	TRANSISTOR: (SEE NOTE) PNP; type M9571
P100	29-82676C01	CONNECTOR, plug: test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contact
R1		RESISTOR, fixed: ±10%; 1/2 W unless otherwise stated
R2	17-82177B04	NOT USED
R3	6-124A33	5; 5 W
R4, 10	6-84640C61	220
R5	6-125C17	499k ±1%
R6	6-124A77	47
R7	6-124A57	15k ±5%; 1/4 W
R8	6-125G15	2.2k ±5%; 1/4 W
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
S1	40-83158C01	SWITCH: rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt

NON-REFERENCED ITEMS

	42-[illegible]	CLAMP, cable; 1/2"
	[illegible]	LUG, control
	42-871184	TERMINAL STRIP, 1-lug
	30-83678P01	CABLE, 8-conductor; 57" long
	15-83947K01	COVER; 2 req'd, fused with P102
	42-[illegible]	CLAMP, cable; 2 req'd,
	[illegible]	TERMINAL BOARD, 18-lug

NOTE

For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

TKN6782A Cable Kit PL-

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
P4	9-84151B03 14-84656B02	CONNECTOR Includes CONTACT, receptacle; 1- HOUSING

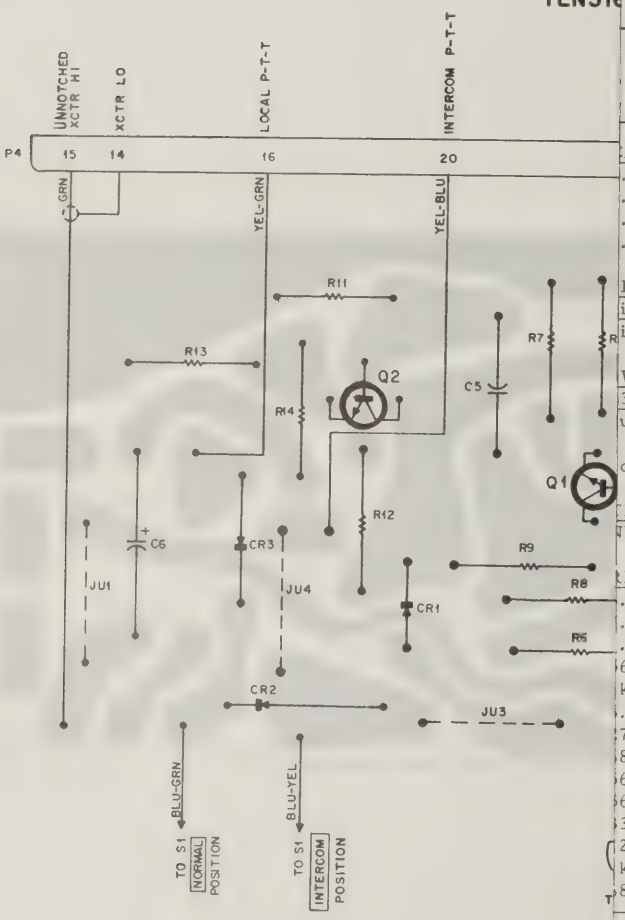
TLN5134A Meter Panel P-

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
DS1	65-83183C02	LIGHT, indicator includes lamp and GRN le
DS2	65-83183C04	includes lamp and RED le
LS1	50-83562A01	LOUDSPEAKER, perma magnet dynamic type; 4" square 4 ohms nom. coil impeda
M1	72-84864B10	METER, rectifier ty scale: 0-25 volts amps
M2	72-84864B09	scale: 0-30 microamperes

NON-REFERENCED ITEMS

	[illegible]	METER, voltmeter
	[illegible]	LIGHT, indicator; green
	[illegible]	LIGHT, indicator; red
	Z-7009	GROMMET, rubber; 1/2" diameter
	1-11991r	SCREW, machine; 6-32 x 3/8"
	1-131964	SCREW, tapping; 4-40 x 1/4"
	4-7n58	WASHER, lock; #4 size; 3/8"
	7-84620G01	BRACKET, top
	7-84620G02	BRACKET, bottom
	[illegible]	PANEL, meter

METERING & INTERCOM



TLN516	DESCRIPTION

PL-5076-O

CAPACITOR, fixed: uF:
. 22 ±10%; 50 V
. 7 ±20%; 25 V
. 22 ±10%; 50 V
. 7 ±20%; 25 V

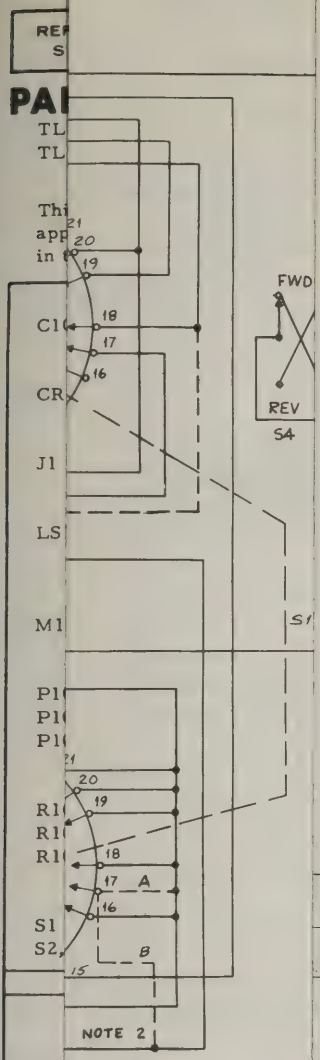
EMICONDUCTOR DEVICE,
iode:
ilicon

WITCH, magnetic reed:
3.4 V DC:
ual-coil; 2 form "A",
form "B"; resistance of each
oil 285 ohms ±10%

RANSISTOR:
NPN; type M9642

ESISTOR, fixed: ±10%; 1/4 W:
. 8k
. 2k
. 5k
60
k
. 8k
7k
8k
60
6
3k
2k
k
80

SHOWI



ISTS OF
METER KIT (CHASSIS)
INTERCOM BOARD KIT
CABLE KIT
METER KIT (CHASSIS)
INTERCOM BOARD KIT
CABLE KIT
INTERCOM KIT (CHASSIS
INTERCOM BOARD KIT
CABLE KIT

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and P101) on either t
5 V full scale readin
divide the 25 V full s
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R-OFF switch in

INTERCOM switch

for intercom operat
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on the microphone

"COMPA-STATION" METERING & INTERCOM

MODELS TLN1857A AND TLN1886A INTERCOM

MODEL TLN1745A

FUNCTION

--Models TLN1857A and TLN1886A provide built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point.

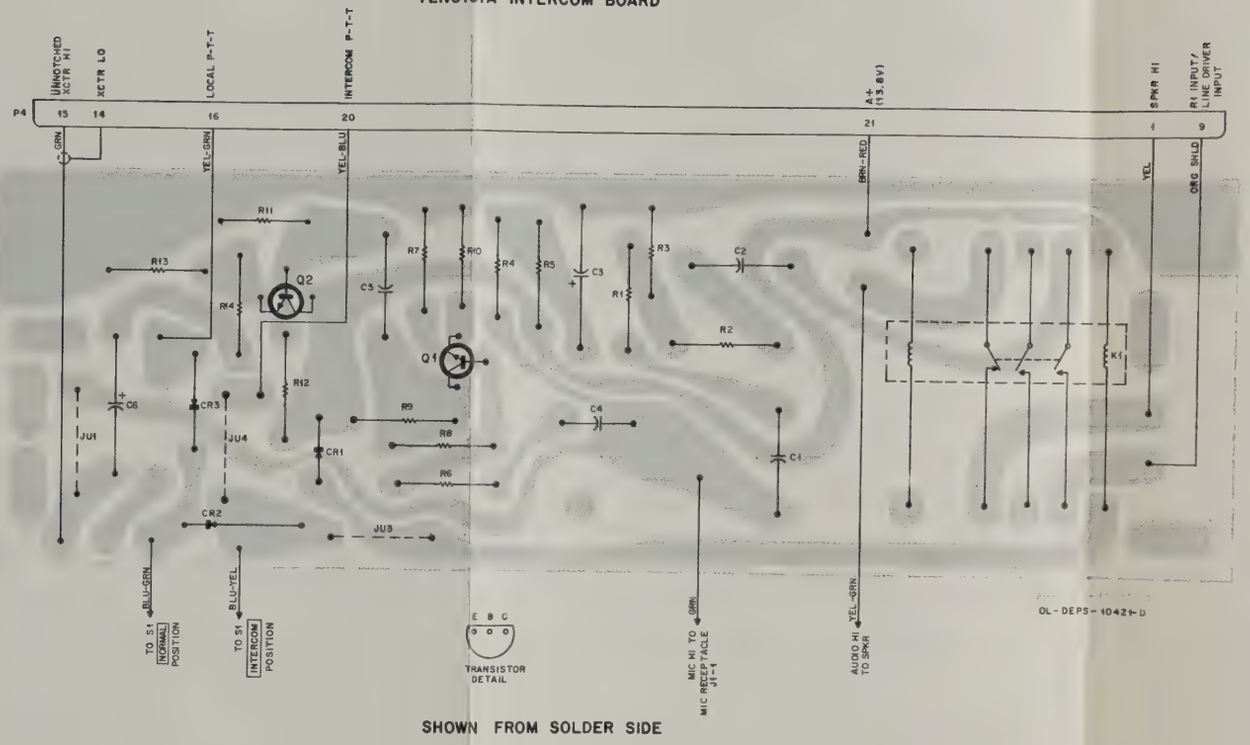
--Model TLN1745A provides intercom between the station and the remote control point.

METER SELECT TABLE

LOW BAND–MID BAND TLN1886A/TLN1887A		HIGH BAND TLN1857/TLN1859A		820 MHz/UHF TLN1857A/TLN1859A	
POL.	FUNCTION METERED	POL.	FUNCTION METERED	POL.	FUNCTION METERED
REV	EXTENDER CHANNEL ELEMENT	REV	–	FWD	CHANNEL ELEMENT OUTPUT
REV	–	REV	–	FWD	FIRST DOUBLER OUTPUT
REV	CHANNEL ELEMENT OUTPUT	REV	CHANNEL ELEMENT OUTPUT	FWD	SECOND DOUBLER OUTPUT
REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
REV	THIRD IF OUTPUT AND LIMITER OUTPUT	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	FWD	LIMITER OUTPUT
FWD	P.A. INPUT	REV	PA INPUT	FWD	PREDRIVER CURRENT
FWD		REV	CONTROLLED AMP OUTPUT	FWD	25 W DRIVER CURRENT (75 W)
FWD	-	REV	INPUT FINAL AMP 90/100 W/60 W PREDRIVER	FWD	FINAL AMP CURRENT (EXCEPT 12 W MODELS)
FWD	CONTROL VOLTAGE	REV	INPUT FINAL AMP	FWD	–
FWD	FINAL AMPLIFIER CURRENT	REV	FINAL AMPLIFIER CURRENT	FWD	CONTROLLED (ADL) STAGE VOLTAGE FINAL AMPLIFIER CURRENT (12 W ONLY)
FWD	CONTROL VOLTAGE	FWD	CONTROL VOLTAGE	FWD	ADL VOLTAGE (ALL OTHERS)
FWD	–			FWD	ADL VOLTAGE NOT USED (800 MHz ONLY)
FWD	REFLECTED POWER	FWD	REFLECTED POWER	FWD	REFLECTED POWER
FWD	FORWARD POWER	FWD	FORWARD POWER	FWD	FORWARD POWER
	UNUSED		UNUSED		UNUSED
FWD	SECOND AMPLIFIER – (LB) DRIVER INPUT – (MB)	FWD	EXCITER OUTPUT	FWD	EXCITER OUTPUT
FWD	FIRST AMPLIFIER – (LB) DOUBLER INPUT – (MB)	FWD	FIRST DOUBLER INPUT	FWD	DOUBLER INPUT
FWD	TRIPLER INPUT	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT
FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT
FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT
FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE
FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE: METER IS LABELLED 0–50
	OFF		OFF		OFF

EPS–23014–A

TLN5167A INTERCOM BOARD



SHOWN FROM SOLDER SIDE

PARTS LIST

TLN5167A Intercom Board — PL-5076-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: uF:
C1, 2	8-82905G11	0.22 ±10%; 50 V
C3	23-865137	4.7 ±20%; 25 V
C4, 5	8-82905G11	0.22 ±10%; 50 V
C6	23-865137	4.7 ±20%; 25 V
		SEMICONDUCTOR DEVICE, diode:
CR1 thru 5	48-83654H01	silicon
		SWITCH, magnetic reed: 13.4 V DC:
K1	80-84157B02	dual-coil; 2 form "A", 1 form "B"; resistance of each coil 285 ohms ±10%
		TRANSISTOR:
Q1, 2	48-869642	NPN; type M9642
		RESISTOR, fixed: ±10%; 1/4 W:
R1	6-124C69	6.8k
R2	6-124C51	1.2k
R3	6-124C53	1.5k
R4	6-124C43	560
R5	6-124C49	1k
R6	6-124C69	6.8k
R7	6-124C83	27k
R8	6-124C93	68k
R9	6-124C43	560
R10	6-124C19	56
R11	6-124C85	33k
R12	6-124C75	12k
R13	6-124C49	1k
R14	6-124C45	680

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN1900A Meter Kit
TLN6993A Meter Kit

NOTE
This parts list covers two meter kits. Where differences appear the model number of the applicable kit is indicated in the description column. PL-5077-O

C100	21-82428B24	CAPACITOR, fixed: .01 uF +80-20%, 500 V
CR100, 101	48-82420C03	DIODE: (SEE NOTE) silicon
J1	9-830418	CONNECTOR, receptacle: 4-contact
LS1	50-84710G01	LOUDSPEAKER, permanent: dynamic type; 3"; square 16-ohms voice coil impedance
M100	72-83120C02	METER, dc: scale; 0-50 microamperes
P100	29-82676C01	CONNECTOR, plug: test probe; BLACK
P101	29-8267oC02	test probe; RED
P102	28-84208B01	7-contacts
R100	8-84640C61	RESISTOR, fixed: 499k ±0.5%; 1/4 W
R101	6-1376oD88	100k ±1%; 1/2 W
R102	6-124A33	220 ohm ±5%; 1/4 W
S1	40-83158C01	SWITCH: rotary; 2 section
S2, 3	40-83890A01	slide; dpst
	NON-REFERENCED ITEMS	
	1-80775R9e	DIODE & CAPACITOR ASSEMBLY includes: DIODES CR100 & CR101 CAPACITOR C100
	1-80775B58	CABLE ASSEMBLY includes:
	3-129674	SCREW, machine; 4-40 x 3/16"; 2 used
	3-132341	SCREW, machine: 4-36 x 1/4"; 2 used
	15-83947K01	COVER, connector; 2 used
	30-83678K01	CABLE, 7-conductor; 42"lg.
	42-83948K01	CLAMP, cable; 2 used
	1-80775B61	VOLTMETER PROBE: includes: CONNECTORS P100 & P101
	1-80792B23	SWITCH ASSEMBLY, wired (TLN5900A) includes: SWITCH S1
	1-80795B11	SWITCH ASSEMBLY, wired (TLN5993A) includes: SWITCH S1
	1-80792B24	CHASSIS ASSEMBLY includes:
	4-7555	WASHER, flat; .128 x .250 x .033"; 2 used
	27-83008K03	CHASSIS, metering
	31-490181	TERMINAL STRIP; 2-termina; 2 used
	42-871184	CLIP, mounting; 2 used
		SWITCHES S2, S3, & S4
	1-80793B04	COVER ASSEMBLY includes:
	1-80793B05	COVER SUBASSEMBLY includes: COVER
	15-82734L01	SCREW, tapping; 6-32 x
	3-136138	3/8"; 2 used
	42-83123F01	RETAINER, screws; 2 used
	75-838826	BUMPER, rubber; 4 used
	2-7005	NUT, hex; 6-32 x 1/4 x 3/32"
	2-7018	NUT, hex; 3/8-32 x 1/2 x 3/32"
	2-132616	NUT, hex; 6-32 x 1/4 x 3/32"; 4 used
	2-83896G01	NUT, special; 13-16-27 x .905 x .110

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	3-7331	SCREW, machine; 6-32 x 3/8
	3-129498	SCREW, machine; 6-32 x 5/16; 4 used
	3-134169	SCREW, tapping; 4-40 x 1/4; 6 used
	3-135111	SCREW, tapping; 4-40 x 3/8
	4-7568	WASHER, flat; .378 x .562 x .06?
	4-7650	WASHER, lock; #6 (internal tooth)
	4-7698	WASHER, lock; #3/8 (internal tooth)
	4-7699	WASHER, lock; #13/16 (internal tooth)
	4-114057	WASHER, flat; .125 x .312 x .032"
	4-8580o6	WASHER, insulating; .125 x 7/32 x .060"; 3 used
	5-483208	GORMMET; rubber; 1/2" ID
	7-83198K01	BRACKET, meter
	14-84717F01	INSULATOR; .68 x .40"
	29-5247	LUG, soldering; #1/4 L; 2 used
	29-115147	LUG, soldering; #5
	35-84630G01	GRILLE, speaker
	36-84356C01	KNOB, pointer
	42-859067	CLAMP, cable; 1/2" OD (black)
	42-10217A02	STRAP, cable harness; 4 used
	42-82143C02	CLAMP, cable; 1/4" OD (black)
	54-83147L01	LABEL, caution

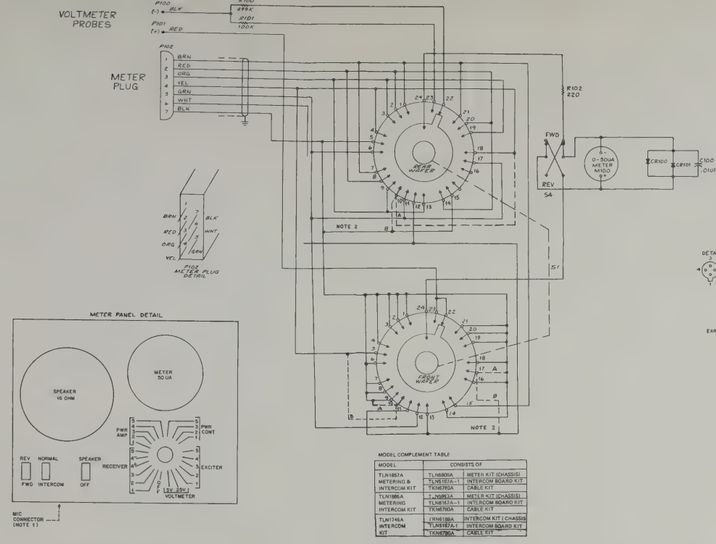
TKNo780A Cable Kit PL-3418-A

P4	-	CONNECTOR; includes:
	9-84151B03	CONTACT, receptacle; 10 req'd
	14-84556B02	HOUSING
	NON-REFERENCED ITEM	
	42-10217A02	STRAP, cable harness; 7 used

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

TRNo189A Intercom Chassis Kit PL-3452-O

J1	9-830418	CONNECTOR, receptacle; 4-contact
LS1	50-84710G01	SPEAKER 3"; 16 ohm
S2, 3	40-83589	SWITCH, slide; DPST
	NON-REFERENCED ITEMS	
	1-80775B59	CHASSIS (riveted) incl. ref. nos. 52 and 53
	1-80775B51	COVER ASSEMBLY
	2-132616	LOCKNUT, speaker (No. 6-32) 4 req'd.
	2-83896G01	NUT, hex (used with J1)
	4-7699	LOCKWASHER (used with J1)
	5-483208	GROMMET, rubber
	35-84630G01	GRILLE, speaker
	42-82143C02	CLAMP, cable (1/4")
	42-10217A02	TY-WRAP, cable; 4 req'd.
	3-134169	SCREW, machine; No. 4-40 x 1/4"; 7 req'd.
	3-129498	SCREW, machine; No. 6-32 x 5/16"; 4 req'd.
	29-115147	LUG, solder (No. 5)



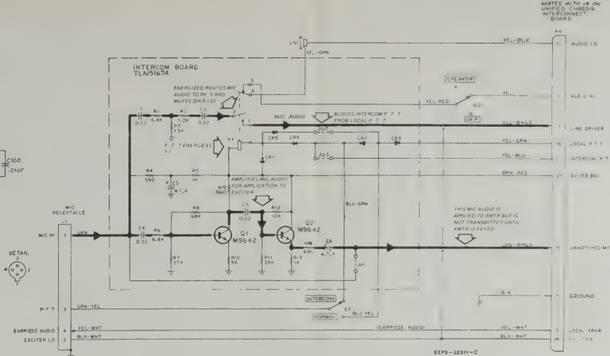
MODEL COMPLEMENT TABLE

MODEL	CONSISTS OF	
TLN1857A METERING & INTERCOM KIT	TLN6900A	METER KIT (CHASSIS)
	TLN6921A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT
TLN1886A METERING INTERCOM KIT	TLN6993A	METER KIT (CHASSIS)
	TLN6921A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT
TLN1745A INTERCOM	TRN6189A	INTERCOM KIT (CHASSIS)
	TLN6921A-1	INTERCOM BOARD KIT
	TKN6780A	CABLE KIT

JUMPER TABLE

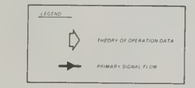
JUMPER	NORMAL	WHEN "SPECTRA TAC" IS ADDED (CUT CRO)
JU1	OUT	OUT
JU2	OUT	IN
JU3	OUT	IN

3. LEADS A CONNECTED FOR TLN6900A. LEADS B CONNECTED FOR TLN6993A.


INTERCOM BOARD TLN5167A
MATES WITH J4 ON UNIFIED CHASSIS INTERCONNECT BOARD
ENERGIZED ROUTES MIC AUDIO TO PA 1 AND MUTES SPKR LS1
MIC AUDIO
BLOCKS INTERCOM P T T FROM LOCAL P T T
P T T ENERGIZES
LOCAL P T T
INTERCOM P T T
LINE DRIVER INPUT
MIC AUDIO IS SUITABLY APPLIED TO REMOTE CONTROL POINT
AMPLIFIES MIC AUDIO FOR APPLICATION TO RADIO EXCITER
THIS MIC AUDIO IS APPLIED TO XMTR BUT IS NOT TRANSMITTED UNTIL XMTR IS KEYED
UNNOTCHED MIC HI
GROUND
MIC RECEPTACLE
MIC HI
DETAIL A
P-T-T
EARPIECE AUDIO
EXCITER LO
INTERCOM
NORMAL
EARPIECE AUDIO
LOCAL SPKR
EE-P1-2231-C

NOTE:
WITH 10 STATIONS, FINAL PA CURRENT IS METERED AT PWR CONT MTR 5. WITH ALL OTHER STATIONS, FINAL PA CURRENT IS METERED AT PA MTR 3

NOTE
1. THIS OPTION REQUIRES THE USE OF A MOTOROLA MODEL TKN6031A MICROPHONE OR EQUIVALENT



OPERATING INSTRUCTIONS

1. METERING

Step 1. Select the function to be metered with the METER switch.

Step 2. Select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board or the power amplifier.

NOTE
Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used.

Step 3. For receiver discriminator adjustment, use both 4(+) and 4(-) and adjust for meter zero.

Step 4. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 5. To measure miscellaneous station voltages, use the voltmeter probes (P100 and P101) on either the 5 V or 25 V positions. Divide the 5 V full scale reading by 10 to obtain actual voltage and divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speaker into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER-OFF switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER-OFF switch in the SPEAKER position.

Step 3. Place the NORMAL-INTERCOM switch in the NORMAL position.

Step 4. The unit is now ready for "ON-THE-AIR" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER-OFF switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER-OFF switch in the SPEAKER position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

"COMPA-STATION" METERING & INTERCOM

MODELS TLN1857A AND TLN1886A

INTERCOM

MODEL TLN1745A

[redacted]

FUNCTION

--Models TLN1857A and TLN1886A provide built-in metering of over 20 major test points in the transmitter and receiver(s), plus intercom between the station and the remote control point

--Model TLN1745A provides intercom between the station and the remote control point

METER SELECT TABLE

P102 METER PLUG (CONNECTED TO)	METER SELECTOR SWITCH MTR NO.	POS	POL	LOW BAND--MID BAND TLN1886A/TLN1887A FUNCTION METERED	POL	HIGH BAND TLN1857/TLN1858A FUNCTION METERED	POL	820 MHz UHF TLN1857A/TLN1858A FUNCTION METERED
RCVR AND Y BOARD	RCVR 1	1	REV	EXTENDER CHANNEL ELEMENT	REV	-	FWD	[redacted]
	2	2	REV		REV	-	FWD	[redacted]
	3	3	REV	CHANNEL ELEMENT OUTPUT	REV	CHANNEL ELEMENT OUTPUT	FWD	[redacted]
	4+	4	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
	4-	5	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
	5	6	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	FWD	LIMITER OUTPUT
POWER AMP	PWR AMP 1	7	FWD	P A INPUT	REV	PA INPUT	FWD	PREDRIVER CURRENT
	2	8	FWD		REV	CONTROLLED AMP	FWD	25 W DRIVER CURRENT
	3	9	FWD	-	REV	INPUT FINAL AMP	FWD	FINAL AMPLIFIER CURRENT
	4	10	FWD	CONTROL VOLTAGE	REV	INPUT FINAL AMP	FWD	[redacted]
	5	11	FWD	FINAL AMPLIFIER CURRENT	REV	FINAL AMPLIFIER CURRENT	FWD	CONTROLLED ADJ. STATION FINAL AMPLIFIER CURRENT (2 W ONLY)
POWER CONTROL BOARD	POWER CONT. 5	12	FWD	CONTROL VOLTAGE	FWD	CONTROL VOLTAGE	FWD	ADJ. VOLTAGE (ALL OTHER)
	3	13	FWD	-	FWD	-	FWD	ADJ. VOLTAGE (HIGH POWER)
	2	14	FWD	REFLECTED POWER	FWD	REFLECTED POWER	FWD	REFLECTED POWER
	1	15	FWD	FORWARD POWER	FWD	FORWARD POWER	FWD	FORWARD POWER
		16		UNUSED		UNUSED		UNUSED
EXCITER	EXCTR 5	17	FWD	SECOND AMPLIFIER (LB) DRIVER INPUT (MB)	FWD	EXCITER OUTPUT	FWD	EXCITER OUTPUT
	4	18	FWD	FIRST AMPLIFIER (LB) DOUBLER INPUT (MB)	FWD	FIRST DOUBLER INPUT	FWD	DOUBLER INPUT
	3	19	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT
	2	20	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT	FWD	[redacted]
				-		-		[redacted]
	1	21	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT
	VOLT METER 25 V	22	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE
	5 V	23	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0-50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0-50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0-50
	OFF	24		OFF		OFF		OFF

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLN5901A Meter Kit
TLN5994A Meter Kit

NOTE

This parts list covers two meter kits. Where differences appear the model number of the applicable kit is indicated in the description column.

PL-5078-O

		DIODE: (SEE NOTE)
CR1	48-82392B03	silicon
		CONNECTOR, receptacle:
J1	9-830418	4-contact
		TRANSISTOR: (SEE NOTE)
Q1	48-869571	PNP; type M9571
		CONNECTOR, plug:
P100	29-82676C01	test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84208B01	7-contact
		RESISTOR, fixed: ±10%; 1/2 W: unless otherwise stated
R1		NOT USED
R2	17-82177B04	5; 5 W
R3	6-124A33	220
R4, 10	6-84640C61	499k ±1%
R5	6-125C17	47
R6	6-124A77	15k ±5%; 1/4 W
R7	6-124A57	2.2k ±5%; 1/4 W
R8	6-125C15	39
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
		SWITCH:
S1	40-83158C01	rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt
S5	40-83890A01	slide; dpdt
	NON-REFERENCED ITEMS	
	1-80775B55	CABLE ASSEMBLY includes:
	3-129674	SCREW, machine: 4-40 x 3/16"; 2 used
	3-132341	SCREW, machine: 4-36 x 1/4" 2 used
	15-83947K01	COVER, connector: 2 used
	30-83678K01	CLAMP, cable; 2 used
		CONNECTOR P102
	1-80775B60	VOLTMETER PROBES includes:
		CONNECTORS P100 & P101
	1-80792B39	SWITCH ASSEMBLY, wired (TLN5901A)
	1-80795B12	SWITCH ASSEMBLY, wired (TLN5994A) includes:
		SWITCH S1
	1-80793B03	CHASSIS ASSEMBLY includes:
	4-7555	WASHER, flat: .128 x .250 x .033"; 3 used
	27-83400K02	CHASSIS, metering
	29-115147	LUG, soldering: #5
	31-490101	TERMINAL STRIP: 2-terminal; 2 used
	42-871184	CLIP, mounting; 3 used
	2-7018	NUT, hex: 3/8-32 x 1/2 x 3/32
	2-115190	NUT, hex: 15/32-32 x 9/16 x 5/64"
	2-121841	NUT, hex: 6-32 x 5/16 x 7/64"
	2-83896G01	NUT, special: 13/16-27 x .905 x .110"
	3-134185	SCREW, tapping: 6-32 x 1/4: 2 used
	3-134212	SCREW, tapping: 4-40 x 5/16; 3 used
	3-136934	SCREW, tapping: 6-32 x 3/8"
	4-7698	WASHER, lock: #3/8 (internal tooth)
	4-7699	WASHER, lock: #13/16 (internal tooth)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	4-8324	WASHER, lock: #15/32 (split
	14-84717F01	INSULATOR: .68 x .40"
	29-5279	LUG, soldering: #7/8
	31-835961	TERMINAL STRIP, 18-termi al
	36-82630H01	KNOB, control
	42-890499	CLAMP, cable: 3.18 x .62"
	42-10217A02	STRAP, cable harness

TKN6886A Cable Kit PL-5207-A

		CONNECTOR:
P4	-	includes:
	9-84151B03	CONTACT, receptacle: 12 use
	14-84556B02	HOUSING, connector
	NON-REFERENCED ITEMS	
	14-859051	INSULATOR, lug: .315 x .945' 6 used
	29-5247	LUG, soldering: #1/4 L; 4 use
	29-824456	LUG, ring tongue: 2 used
	29-859118	LUG, receptacle: .295 x .750" 6 used
	37-82603D60	SLEEVE, numbered; blank
	39-10184A24	CONTACT, female
	42-10217A02	STRAP, cable harness; 3.62" lg.; 28 used
	42-10217A10	STRAP, cable harness; 7.78" lg.; 4 used
	9-84234E10	JACK, test; white; 3 used

TLN5134A Meter Panel PL-223

		LIGHT, indicator:
DS1	65-83183G02	includes lamp and GRN lens
DS2	65-83183G04	includes lamp and RED lens
		LOUDSPEAKER, permanent magnet:
LS1	50-83562A01	dynamic type; 4"; square; 4 ohms voice coil impedance
		METER, electrical: 50 uA movements:
M1	72-84864B10	scale: 0-25 volts/amps
M2	72-84864B09	scale: 0-50 microamperes
	NON-REFERENCED ITEMS	
	13-84616G01	GRILLE, speaker
	13-83207F01	CLOTH, speaker grille
	42-83112A01	CLIP, indicator light retaining 2 used
	2-7009	NUT, hex: 10-32 x 3/8 x 1/8"; 4 used
	3-119916	SCREW, machine: 10-32 x 7/1 4 used
	3-131964	SCREW, tapping: 6-32 x 3/8; 12 used
	4-7658	WASHER, lock: #10 (split); 4 used
	7-84620G01	FRAME, top
	7-84620G03	FRAME, bottom
	7-84620G05	FRAME, end: 2 used
	13-83054C10	GRILLE, meter panel
	64-83152C03	PANEL, meter

CONDENSED CONTENTS

TAB 1

DESCRIPTION
INSTALLATION
MAINTENANCE

TAB 2

EXCITER/1ST BANDPASS FILTER
TRIPLER AND DOUBLER
INTERMEDIATE POWER AMPLIFIER
DIRECTIONAL COUPLER
POWER CONTROL BOARD
FINAL POWER AMPLIFIER
TRANSMITTER INTERCONNECT BOARD
TONE "PL" ENCODER
"DIGITAL PL" ENCODER (SIMPLEX)
"DIGITAL PL" ENCODER (DUPLEX)

TAB 3

RF AND I–F DECK
AUDIO AND SQUELCH BOARD
AUDIO POWER AMPLIFIER
TONE "PL" DECODER
"DIGITAL PL" DECODER

TAB 4

HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY

UPRIGHT STATION METERING & INTERCOM

MODELS TLN1859A AND TLN1887A

FUNCTION

Provides built-in metering of over 20 major test points in the transmitter and receiver(s). Plus intercom between the station and the remote control point.

METER SELECT TABLE

PIC2 METER PLUG CONNECTED TO	METER SELECTOR SWITCH: MTR NO.	POS.	LOW BAND–MID BAND TLN1886A/TLN1887A: POL	FUNCTION METERED	HIGH BAND TLN1857/TLN1858A: POL	FUNCTION METERED	820 MHz/UHF TLN1857A/TLN1858A: POL	FUNCTION METERED
RCVR AND IF BOARD	RCVR	1	REV	EXTENDER CHANNEL ELEMENT	–	–	FWD	CHANNEL ELEMENT OUTPUT
		2	REV		REV		FWD	FIRST DOUBLER OUTPUT
		3	REV	CHANNEL ELEMENT OUTPUT	REV	CHANNEL ELEMENT OUTPUT	FWD	SECOND DOUBLER OUTPUT
		4	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT
		5	REV	DISCRIMINATOR OUTPUT	REV	DISCRIMINATOR OUTPUT	FWD	DISCRIMINATOR OUTPUT
		6	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	REV	THIRD IF OUTPUT AND LIMITER OUTPUT	FWD	LIMITER OUTPUT
POWER AMP	PWR AMP	1	FWD	P.A. INPUT	REV	PA INPUT	FWD	PREDRIVER CURRENT
		2	FWD	–	REV	CONTROLLED AMP OUTPUT	FWD	25 W DRIVER CURRENT (75 W)
		3	FWD	–	REV	INPUT FINAL AMP	FWD	FINAL AMP CURRENT (EXCEPT 12 W MODELS)
		4	FWD	CONTROL VOLTAGE	REV	INPUT FINAL AMP	FWD	
		5	FWD	FINAL AMPLIFIER CURRENT	REV	FINAL AMPLIFIER CURRENT	FWD	CONTROLLED (ADJ.) STAGE VOLTAGE FINAL AMPLIFIER CURRENT (12 W ONLY)
POWER CONTROL BOARD	POWER CONT	5	FWD	CONTROL VOLTAGE	FWD	CONTROL VOLTAGE	FWD	ADJ. VOLTAGE (ALL OTHERS) ADJ. VOLTAGE NOT USED (800 MHz ONLY)
		12	FWD	–	–	–	FWD	
		14	FWD	REFLECTED POWER	FWD	REFLECTED POWER	FWD	REFLECTED POWER
		15	FWD	FORWARD POWER	FWD	FORWARD POWER	FWD	FORWARD POWER
–	–	16	–	UNUSED	–	UNUSED	–	UNUSED
EXCITER	EXCTR	17	FWD	SECOND AMPLIFIER – (LB) DRIVER INPUT – (MB)	FWD	EXCITER OUTPUT	FWD	EXCITER OUTPUT
		18	FWD	FIRST AMPLIFIER – (LB) DOUBLER INPUT – (MB)	FWD	FIRST DOUBLER INPUT	FWD	DOUBLER INPUT
		19	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT	FWD	TRIPLER INPUT
		20	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT	FWD	CHANNEL ELEMENT OUTPUT
		21	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT	FWD	IDC AUDIO OUTPUT
	VOLT METER	22	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE	FWD	25 VOLTS FULL SCALE
		23	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0–50	FWD	5 VOLTS FULL SCALE NOTE METER IS LABELLED 0–50
	OFF	–	24	OFF	–	OFF	–	OFF

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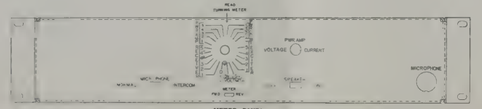

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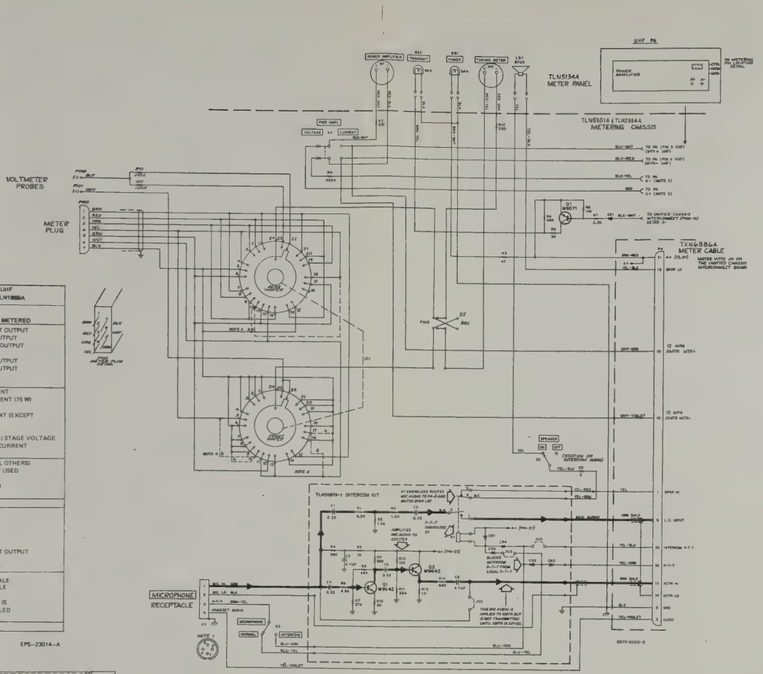

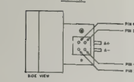

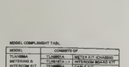

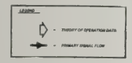

OPERATING INSTRUCTIONS

1. METERING

Step 1. Tuning Meter Usage -- Select the function to be metered with the meter switch. Next, select the chassis to be monitored by placing the metering plug (P102) into the metering receptacle of the receiver, exciter, power control board, or the power amplifier. NOTE: Metering plug P102 should be plugged in only when tuning. Unplug it when it is not being used. For receiver discriminator adjustment, use both 4(+) and 4(-) and adjust for meter zero.

Step 2. PWR AMP Meter Usage -- Select PA current/voltage monitoring by placing the VOLTAGE/CURRENT switch in the applicable position.

Step 3. Refer to the Transmitter and Receiver sections of this manual for typical or minimum readings. Better yet, keep a log of all meter readings each time the station is serviced. Use the last set of readings as a reference and note any degradation in performance.

Step 4. Voltmeter Usage -- Use either the 5 V or 25 V scales as applicable. Divide the 5 V full scale reading by 10 to obtain actual voltage. Divide the 25 V full scale reading by 2 to obtain actual voltage.

2. INTERCOM

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM switch in the INTERCOM position.

Step 4. The unit is now ready for intercom operation between the station and the remote control point. Close the PUSH-TO-TALK switch on the microphone and speak into the microphone to send a message. Release the button to listen; replies will be heard in the speaker. The console operator at the remote point must also switch to an intercom mode to prevent keying the station during replies.

Step 5. Return the SPEAKER switch to the OFF position before leaving the station unattended.

3. "ON-THE-AIR" TESTING

Step 1. Connect a test microphone to the microphone receptacle on the meter & intercom chassis.

Step 2. Place the SPEAKER switch in the ON position.

Step 3. Place the NORMAL-INTERCOM in the NORMAL position.

Step 4. The unit is now ready for "on-the-air" testing. If the microphone PUSH-TO-TALK switch is closed, the station's transmitter will be keyed. Speak into the microphone to transmit a message. Release the PUSH-TO-TALK switch to listen. Receiver audio will be heard on the speaker.

Step 5. Return the SPEAKER switch to OFF before leaving the station unattended.

4. MONITORING

To monitor audio quality, etc., place the SPEAKER switch in the ON position. Both receiver audio and line audio from the remote control point will be heard in the speaker.

PARTS LIST

TLN5901A Meter Kit
TLN5994A Meter Kit

NOTE

This parts list covers two meter kits. Where differences appear the model number of the applicable kit is indicated in the description column.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		PL-5078-O
CR1	48-82392B03	DIODE: (SEE NOTE) silicon
J1	9-830418	CONNECTOR, receptacle: 4-contact
Q1	48-869571	TRANSISTOR: (SEE NOTE) PNP; type M9571
P100	29-82676C01	CONNECTOR, plug: test probe; BLACK
P101	29-82676C02	test probe; RED
P102	28-84203B01	7-contact
R1		RESISTOR, fixed ±10%, 1/2 W unless otherwise stated NOT USED
R2	17-82177B04	5; 5 W
R3	6-124A33	220
R4, 10	6-84640C61	499k ±1%
R5	6-125C17	47
R6	6-124A77	15k ±5%; 1/4 W
R7	6-124A57	2.2k ±5%; 1/4 W
R8	6-125C18	39
R9	6-125A39	390
R11	6-12756D88	100k ±1%
R12	6-125A33	220 ±5%
S1	40-83158C01	SWITCH: rotary; 2 section
S2, 3	40-83890A01	slide; dpdt
S4	40-811751	toggle; dpdt
S5	40-83890A01	slide; dpdt
	NON-REFERENCED ITEMS	
	1-80775B55	CABLE ASSEMBLY includes:
	3-129674	SCREW, machine: 4-40 x 3/16"; 2 used
	3-132341	SCREW, machine: 4-36 x 1/4" 2 used
	15-83947K01	COVER, connector: 2 used
	30-83678K01	CLAMP, cable: 2 used
		CONNECTOR P102
	1-80775B60	VOLTMETER PROBES includes: CONNECTORS P100 & P101
	1-80792B39	SWITCH ASSEMBLY, wired (TLN5901A)
	1-80795B12	SWITCH ASSEMBLY, wired (TLN5994A) includes: SWITCH S1
	1-80793B03	CHASSIS, assembly includes:
	4-7555	WASHER, flat: .128 x .250 x .032"; 3 used
	27-83400K02	CHASSIS, meter mtg
	29-115147	LUG, soldering #8
	31-490101	TERMINAL STRIP: 2-terminal; 2 used
	42-871184	CLIP, mounting; 3 used
	2-7018	NUT, hex: 3/8-32 x 1/2 x 3/32
	2-115190	NUT, hex: 15/32-32 x 9/16 x 5/64"
	2-121841	NUT, hex: 6-32 x 5/16 x 7/64"
	2-83896G01	NUT, special: 13/16-27 x .905 x .110"
	3-134185	SCREW, tapping: 6-32 x 1/4 2 used
	3-134212	SCREW, tapping: 4-40 x 5/16; 3 used
	3-136934	SCREW, tapping: 6-32 x 3/8"
	4-7698	WASHER, lock: #3/8 (internal tooth)
	4-7699	WASHER, lock: #13/16 (internal tooth)

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
	4-8324	WASHER, lock: #15/32 (e
	14-84717F01	INSULATOR: .68 x .40"
	29-5279	LUG, soldering: #7/8
	31-835961	TERMINAL STRIP, 18-ter al
	36-82630H01	KNOB, control
	42-890499	CLAMP, cable: 3.18 x .4
	42-10217A02	STRAP, cable harness

TKN6886A Cable Kit PL-52

P4	–	CONNECTOR includes:
	9-84151B03	CONTACT, receptacle
	14-84656B02	HOUSING, connector
	NON-REFERENCED ITEMS	
	14-859051	INSULATOR, bar .31 x 6 used
	29-5247	LUG, soldering #1 2
	29-824456	LUG, ring tongue: 2 used
	29-859118	LUG, receptacle: .295 x 6 used
	37-82603D60	SLEEVE, numbered; black
	39-10184A24	CONTACT, female
	42-10217A02	STRAP, cable harness lg.: 28 used
	42-10217A10	STRAP, cable harness lg.: 8 used
	9-84234E10	JACK, test: white: 3 use

TLN5134A Meter Panel P1

DS1	65-83183G02	LIGHT, indicator includes lamp and GRN le
DS2	65-83183G04	includes lamp and RED le
LS1	50-83562A01	LOUDSPEAKER, permanent magnet: dynamic type; 4"; square 4 ohms voice coil impeda
M1	72-84864B10	METER, electrical: 50-u movements: scale: 0-25 volts/amps
M2	72-84864B06	scale: 0-50 microamps/rec
	NON-REFERENCED ITEMS	
	13-84616G01	GRILLE, speaker
	13-83207F01	CLOTH, speaker grille
	42-83112A01	CLIP, indicator light rea 2 used
	2-7004	NUT, hex: 10-32 x 4 used
	3-119916	SCREW, machine: 10-32 x 4 used
	3-131964	SCREW, tapping: 6-32 x 1c used
	4-7658	WASHER, lock: #10 (split 4 used
	7-84620G01	FRAME, top
	7-84620G03	FRAME, bottom
	7-84620G05	FRAME, end: 2 used
	13-83054C10	GRILLE, meter panel
	64-83152C03	PANEL, meter

CONDENSED CONTENTS

TAB 1

DESCRIPTION
INSTALLATION
MAINTENANCE

TAB 2

EXCITER/1ST BANDPASS FILTER
TRIPLER AND DOUBLER
INTERMEDIATE POWER AMPLIFIER
DIRECTIONAL COUPLER
POWER CONTROL BOARD
FINAL POWER AMPLIFIER
TRANSMITTER INTERCONNECT BOARD
TONE "PL" ENCODER
"DIGITAL PL" ENCODER (SIMPLEX)
"DIGITAL PL" ENCODER (DUPLEX)

TAB 3

RF AND I–F DECK
AUDIO AND SQUELCH BOARD
AUDIO POWER AMPLIFIER
TONE "PL" DECODER
"DIGITAL PL" DECODER

TAB 4

HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY

EXCITER/1ST BANDPASS FILTER

MODEL TLF1043A

MODEL COMPLEMENT

MODEL	DESCRIPTION
TLD5491A	Exciter
TFD6383A	1st Bandpass Filter

1. FUNCTIONAL OPERATION

1.1 The exciter provides the low power excitation signal for the transmitter. An "IDC" (Instantaneous Deviation Control) circuit amplifies and limits audio signals from the microphone (or line) to prevent over deviation. Amplified audio is applied to the channel element to produce direct fm modulation. Multipliers in the exciter multiply the channel element frequency 12 times to generate signals in the 141.8-144.3 MHz band.

1.2 The bandpass filter couples 141.8 to 144.3 MHz signals from the exciter to the tripler/doubler amplifier and attenuates any harmonics outside this band.

2. EXCITER ALIGNMENT

2.1 EXCERPTS FROM FCC REGULATIONS

FCC Regulations state that:

1. Radio transmitters may be tuned or adjusted only by persons holding a first or second class commercial radiotelephone operator's license or by personnel working directly under their immediate supervision.

2. The power input to the final radio frequency stage shall not exceed the maximum figure specified on the current station authorization. This power input shall be measured and the results recorded:

   a. When the transmitter is initially installed.
   b. When any change is made in the transmitter which may increase the power input.
   c. At intervals not to exceed one year.

3. Frequency and deviation of a transmitter must be checked:

   a. When it is initially installed.
   b. When any change is made in the transmitter which may affect the carrier frequency or modulation characteristics.
   c. At intervals not to exceed one year.

2.2 LOCAL TRANSMITTER KEYING

NOTE

Before initiating any local transmissions, monitor the channel to insure that it is clear of other transmissions.

The transmitter is keyed locally by either activating the station control module XMIT switch or activating the push-to-talk microphone switch. Voice is transmitted using the local microphone.

2.3 FREQUENCY CALCULATIONS

$$f_o = \frac{f_e}{12} \quad (141.8\text{-}144.3 \text{ MHz})$$

Where: f_o = oscillator frequency

f_e = exciter output frequency

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Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

2.4 TRANSMIT OSCILLATOR FREQUENCY ADJUSTMENT

2.4.1 The transmitter oscillator is a high stability, ovenized unit employing a warp capacitor for fine frequency adjustment. The unit is mounted on the TRN6573A Oscillator Mounting Kit which provides connections to the exciter modulating circuitry.

2.4.2 Perform transmit frequency adjustments as follows:

Step 1. Apply power to the station for 15 minutes to allow the oscillator oven to stabilize.

Step 2. Couple a frequency counter with a time base of at least 0.1 ppm to the PA output. Attach test equipment as indicated in figure 1.

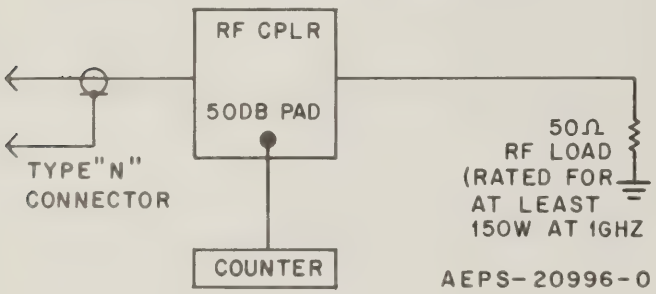


Figure 1. Frequency Adjust Equipment Setup

Step 3. Remove the silver colored plug (labeled FREQ ADJUST) from the end of the oscillator.

Step 4. Using a tuning tool, adjust the screw behind the silver plug until the frequency registered on the counter matches the specified rf carrier frequency.

Step 5. Replace the silver plug and remove all test equipment.

2.5 DEVIATION (IDC) ADJUSTMENT

Step 1. It is assumed that the transmit channel has been "warped" on frequency before attempting to adjust the IDC circuit.

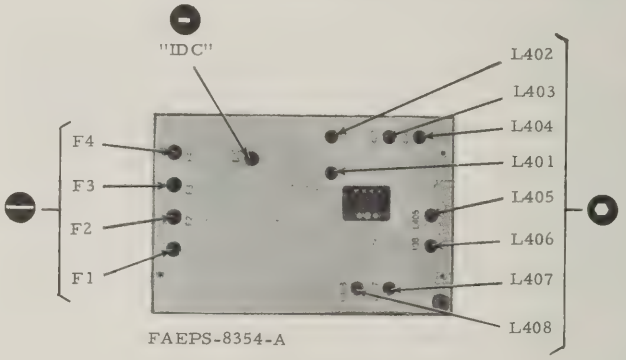
Step 2. Connect an audio oscillator to the exciter input (pin 12, accessible from front of station behind exciter cover).

Step 3. Set the audio-oscillator for 1000 Hz @ 1 volt (rms).

Step 4. Key the transmitter and adjust the IDC control for ±5 kHz deviation.

Step 5. Reduce the audio oscillator output to 0.25 volts. Essentially, full deviation should still be indicated. Less than full deviation may indicate weak or inoperative exciter audio stages.

2.6 EXCITER ALIGNMENT PROCEDURE



Exciter Adjustment Locations

Metering may be performed using either optional built-in metering (if so equipped) or by using a Motorola S1056B thru S1059B Series Portable Test Set. All meter readings are based on a 2000 ohm equivalent series resistance in the meter. Therefore, meters not having a 2000 ohm series resistance must have their readings corrected. The following Exciter Alignment Procedure is written to cover all three cases. The OSC. & METER REV. SWITCH column refers to portable test set usage -- polarity is automatically reversed as required when built-in metering is used.

EXCITER ALIGNMENT PROCEDURE

(Refer to preceding Metering Note)

STEP	ADJUST	METERING PLUG INSERTED INTO	SELECTOR SWITCH POSITION	METER REV. SWITCH AND REF A-B SWITCH (SEE NOTE)	STAGE AND PROCEDURE
1					SET UP - Key the transmitter with the XMTR ON pushbutton on the portable test set.
2	POWER SET				OUTPUT - Turn the POWER SET control fully counterclockwise. Unkey the transmitter.
3	FRE-QUENCY SWITCH	EXCITER	2	OFF REF A	CHANNEL ELEMENT - Select the desired frequency on multi-frequency stations. Key the transmitter. Meter 2 should indicate at least 10 uA.
4	ALL EXCITER COILS	EXCITER	5	OFF REF A	PRE-ALIGNMENT - If the exciter is completely untuned and shows no meter 5 readings, set cores of tuning coils L401 thru L406 to the top of their coil forms (away from circuit board) and preset tuning coils L407 & L408 from circuit board end of coil form per figure 2.
5	L401	EXCITER	2	OFF REF A	BUFFER OUTPUT - Tune L401 for minimum meter reading.
6	L401, L402	EXCITER	3	OFF REF A	BUFFER OUTPUT - Tune L402 and then L401 for peak meter reading.
7	L403	EXCITER	3	OFF REF A	TRIPLER OUTPUT - Tune L403 for minimum meter reading.
8	L403, L404	EXCITER	4	OFF REF A	TRIPLER OUTPUT - Tune L404 and then L403 for peak meter reading.
9	L405	EXCITER	4	OFF REF A	FIRST DOUBLER OUTPUT - Tune L405 for minimum meter reading.
10	L405, L406	EXCITER	5	OFF REF A	FIRST DOUBLER OUTPUT - Tune L406 and then L405 for peak meter reading.
11	L407	EXCITER	5	OFF REF A	EXCITER OUTPUT - Tune L407 for peak meter reading.
12	L407, L408	EXCITER	5	OFF REF A	EXCITER OUTPUT - Tune L408 and then L407 for peak meter reading.
13					Repeat steps 6, 8 and 10.
14					"Power Set" the intermediate power amplifier. (Refer to intermediate power amplifier section of this manual).

should be the first troubleshooting step performed for these symptoms. Many technicians prefer to use alignment as the first troubleshooting step in all cases. During the alignment procedure, any trouble caused by a defective component will be discovered and corrected before alignment can be completed.

3.3.3 Isolating Defective Components

If test set readings are abnormal or tests indicate subnormal performance, a logical troubleshooting procedure is required to isolate the defective component efficiently. The meter readings and results of performance tests usually localize the malfunction to one or two specific stages. A zero meter reading indicates either (1) no drive from the preceding stages, or (2) a defective component in the metering circuit which includes the base-emitter junction of the following transistor which operates as a rectifier. The accompanying troubleshooting chart summarizes these results in a logical sequence. A few voltage and resistance checks in the suspected circuit should readily isolate the defective component. Note that the final amplifier stage of the exciter is powered by A+ and keyed A- and voltages should be checked in respect to keyed A- instead of chassis ground.

TLF1043A Exciter/Bandpass Filter
Troubleshooting Chart, Schematic Diagram, and Circuit Board Detail
Motorola No. PEPS-20986-B
(Sheet 1 of 2)
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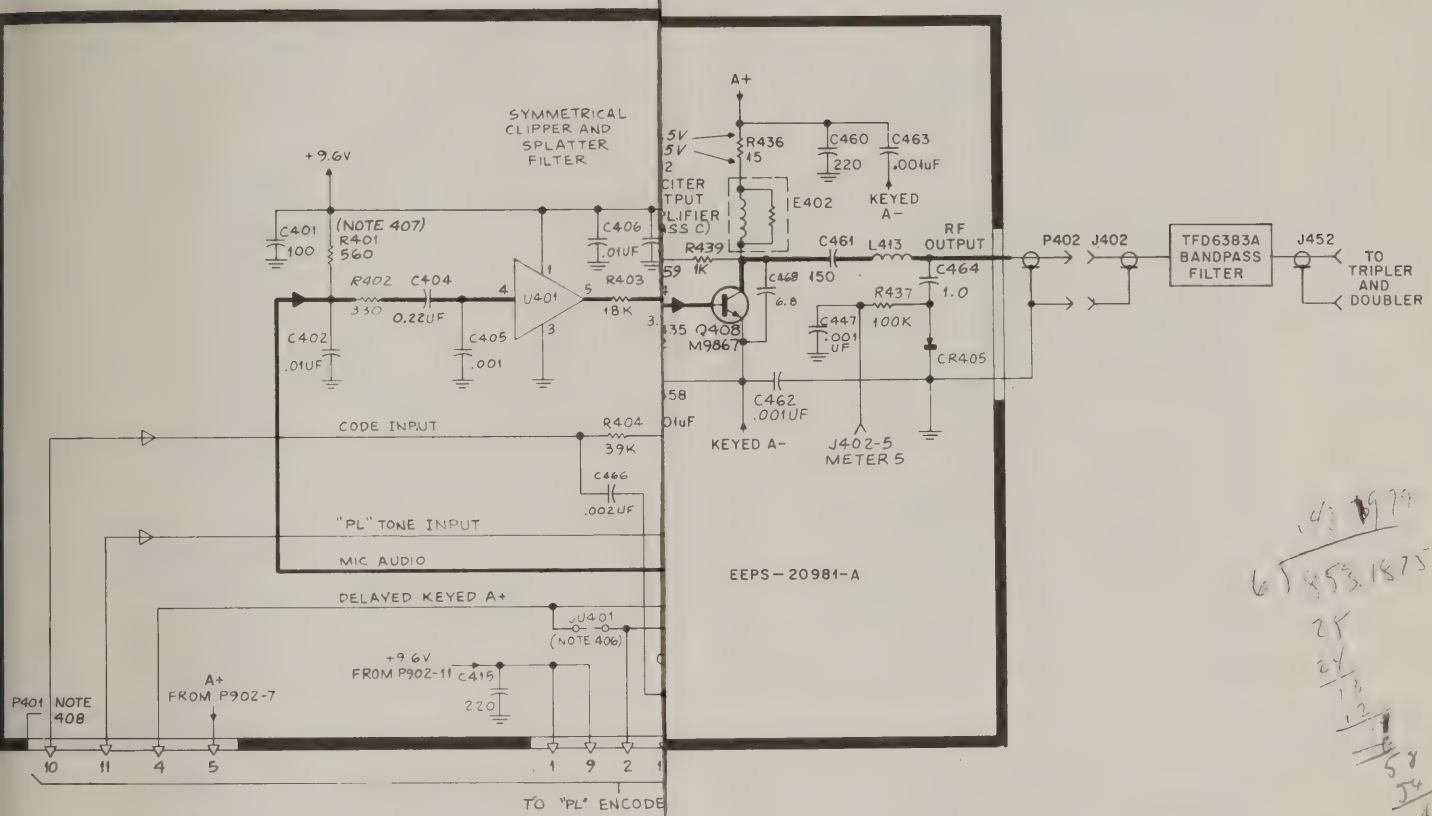


LEGEND

START = CIRCUIT THEORY MOST EASILY UNDERSTOOD BY BEGINNING AT THIS POINT AND FOLLOWING SIGNAL FLOW

= THEORY OF OPERATION DATA

= MAINTENANCE DATA

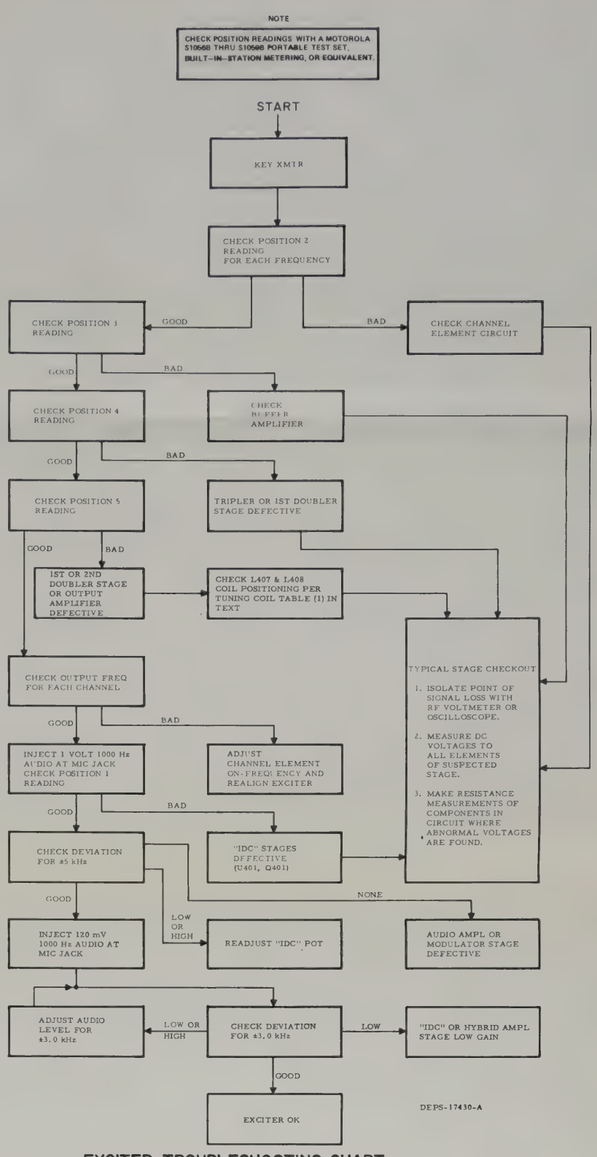
= PRIMARY SIGNAL FLOW

= SECONDARY SIGNAL FLOW

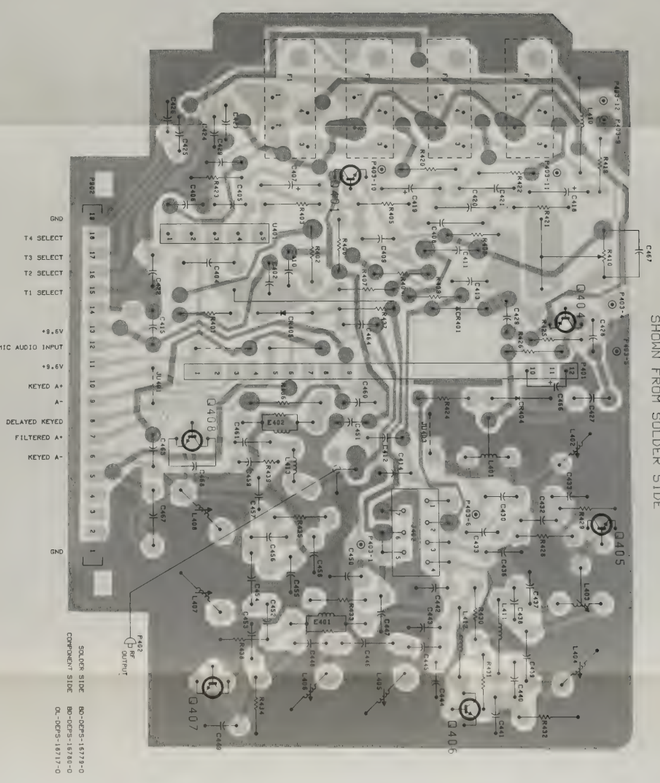
IOWN ON
DIAGRAM

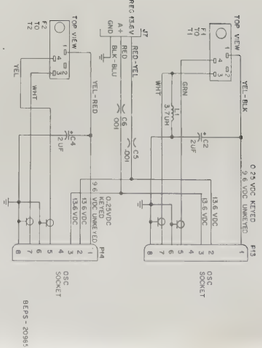
ter/Bandpass Filter
Chart, Schematic Diagram, and Circuit Board Detail
EPS-20986-B

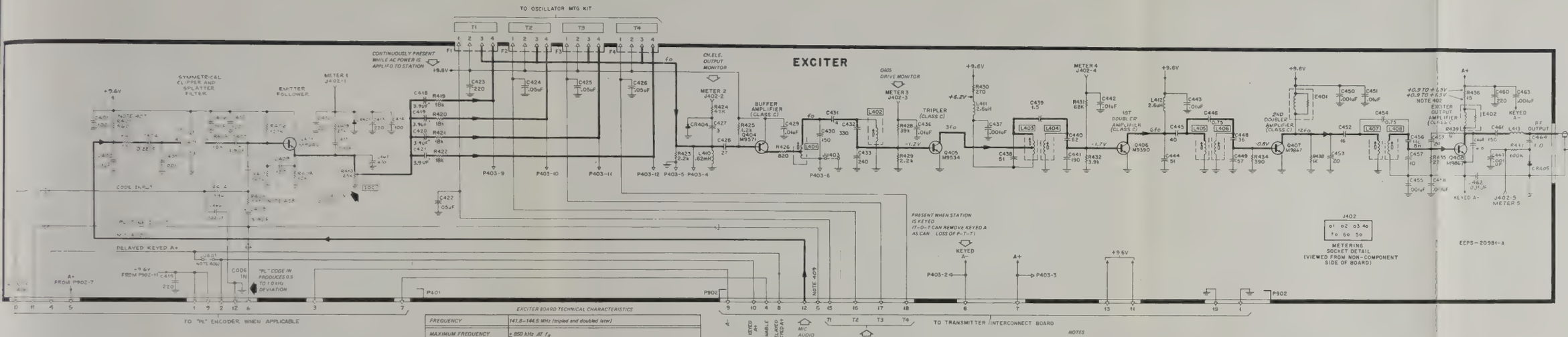
TLF10143A Exciter/Bandpass Filter
Troubleshooting Chart, Schematic Diagram, and Circuit Board Detail
Motorola No. PEPS-20986-B
(Sheet 1 of 2)
3/30/78-NFC


NOTE
CHECK POSITION READINGS WITH A MOTOROLA S1056B THRU S1056E PORTABLE TEST SET, BUILT-IN-STATION METERING, OR EQUIVALENT.
START
KEY XMTR
CHECK POSITION 2 READING FOR EACH FREQUENCY
CHECK POSITION 3 READING
GOOD
BAD
CHECK CHANNEL ELEMENT CIRCUIT
CHECK POSITION 4 READING
CHECK BUFFER AMPLIFIER
CHECK POSITION 5 READING
TRIPLER OR 1ST DOUBLER STAGE DEFECTIVE
1ST OR 2ND DOUBLER STAGE OR OUTPUT AMPLIFIER DEFECTIVE
CHECK L407 & L408 COIL POSITIONING PER TUNING COIL TABLE (1) IN TEXT
TYPICAL STAGE CHECKOUT
1. ISOLATE POINT OF SIGNAL LOSS WITH RF VOLTMETER OR OSCILLOSCOPE.
2. MEASURE DC VOLTAGES TO ALL ELEMENTS OF SUSPECTED STAGE.
3. MAKE RESISTANCE MEASUREMENTS OF COMPONENTS IN CIRCUIT WHERE ABNORMAL VOLTAGES ARE FOUND.
CHECK OUTPUT FREQ FOR EACH CHANNEL
INJECT 1 VOLT 1000 Hz AUDIO AT MIC JACK CHECK POSITION 1 READING
ADJUST CHANNEL ELEMENT ON-FREQUENCY AND REALIGN EXCITER
CHECK DEVIATION FOR ±5 kHz
"IDC" STAGES DEFECTIVE (Q401, Q405)
NONE
INJECT 120 mV 1000 Hz AUDIO AT MIC JACK
LOW OR HIGH
READJUST "IDC" POT
AUDIO AMPL OR MODULATOR STAGE DEFECTIVE
ADJUST AUDIO LEVEL FOR ±3.0 kHz
LOW OR HIGH
CHECK DEVIATION FOR ±3.0 kHz
LOW
"IDC" OR HYBRID AMPL STAGE LOW GAIN
EXCITER OK
DEPS-17430-A

EXCITER TROUBLESHOOTING CHART







EXCITER BOARD TECHNICAL CHARACTERISTICS

FREQUENCY	141.8–144.5 MHz (tripled and doubled later)
MAXIMUM FREQUENCY SEPARATION	± 850 kHz AT f_o
OSCILLATOR FREQUENCY	11.8–12.0 MHz
FREQUENCY MULTIPLICATION	12 TIMES
OUTPUT POWER	400 MILLIWATTS (OUT OF 1ST BANDPASS FILTER)
OUTPUT IMPEDANCE	50 OHMS
MODULATION TYPE	DIRECT FM
DEVIATION	± 5 kHz ADJUSTABLE INSTANTANEOUS DEVIATION LIMITING
AUDIO RESPONSE	6 dB/OCTAVE PRE-EMPHASIS 300 TO 3000 Hz
AUDIO SENSITIVITY	120 MILLIVOLTS ± 3 dB FOR ± 2.0 kHz DEVIATION
AUDIO DISTORTION	LESS THAN 3% AT ± 3.0 kHz DEVIATION FROM 300 TO 3000 Hz
POWER REQUIREMENTS	REGULATED +9.6 VOLTS DC @ 150 mA +13.6 VOLTS DC @ 100 mA
METERING	FIVE TEST POINTS CRITICAL TO OPERATION AND ALIGNMENT ARE ACCESSIBLE AT A METERING RECEPTACLE WHICH PERMITS TESTING WITH AN OPTIONAL BUILT-IN STATION METER MOTOROLA PORTABLE TEST SET OR 0–50 uA MICROAMMETER WITH 2,000 OHMS INTERNAL RESISTANCE
FREQUENCY CALCULATION SEE NOTE 401	$f_o = 12\ f_c$ $f_c = 72\ f_x$ FOR 850 MHz BAND $f_x = \frac{f_o}{12}$ OR $\frac{f_c}{72}$ f_c = CARRIER FREQUENCY f_x = OSCILLATOR CRYSTAL FREQUENCY f_o = EXCITER OUTPUT FREQUENCY

NOTES

401 FREQUENCY CALCULATIONS GIVEN IN ACCOMPANYING TECHNICAL CHARACTERISTICS TABLE NOTE THAT OUTPUT OF EXCITER IS 12 f_x AND NOT FINAL CARRIER FREQUENCY. A FOLLOWING TRIPLER AND DOUBLER MULTIPLIES EXCITER OUTPUT TO THE CARRIER FREQUENCY.

402 VOLTAGE MEASURED ACROSS R436.

403 HIGH IMPEDANCE TRANSISTORIZED VOLTMETERS !!! MEGOHM) NOT RECOMMENDED.

404 UNLESS OTHERWISE STATED VOLTAGES MEASURED IN RESPECT TO CHASSIS GROUND

405 UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN PICOFARADS

406 JU401 REMOVED IN "PRIVATE-LINE" RADIOS

407 R401 REMOVED IN REMOTE CONTROL STATIONS

408 WHEN CODE INPUTS ARE APPLIED VIA P401-10 R405 MUST BE REMOVED FROM THE CIRCUIT

409 IN "PRIVATE-LINE" RADIOS P902-5 IS NOT CONNECTED TO THE TRANSMITTER INTERCONNECT BOARD.

LEGEND

START = CIRCUIT THEORY MOST EASILY UNDERSTOOD BY BEGINNING AT THIS POINT AND FOLLOWING SIGNAL FLOW

= THEORY OF OPERATION DATA

= MAINTENANCE DATA

= PRIMARY SIGNAL FLOW

= SECONDARY SIGNAL FLOW

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLF1043A Exciter/Bandpass Filter
Troubleshooting Chart, Schematic Diagram, and Circuit Board Detail
Motorola No. EEPS-20986-B
(Sheet 2 of 2)
3/30/78-NPC

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

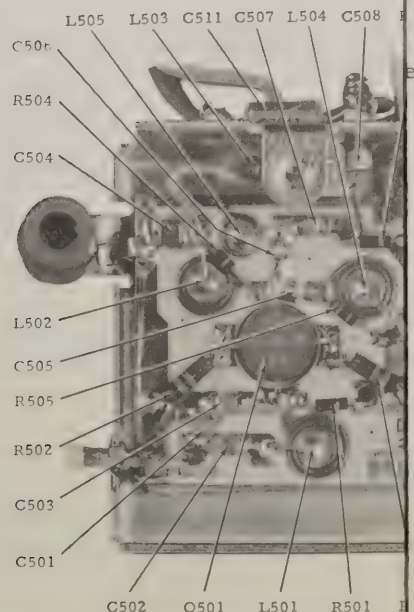
PARTS LIST

TRN6584A Chassis and Hardware Kit PL-4382-A

		CAPACITOR, fixed:
C508	91-87511C01	RF1, filter
C509	23-82783B25	4.7 uF ±10%; 25 V
C510	91-87511C01	RF1, filter
C511, 512	23-82783B25	4.7 uF ±10%; 25 V
C513	91-87511C01	RF1, filter
		CONNECTOR, receptacle:
J502	28-84282D01	male; single contact
J505	28-84282D01	male; single contact
J506	9-84968D01	female; single contact
J507	28-84282D01	male; single contact
		CONNECTOR, plug:
J501		Includes:
	15-83498F05	INSULATOR, 5-circuit
	29-83499F01	CONTACT, male; 3 req'd.
	MECHANICAL PARTS	
	7-82083L01	BRACKET
	15-82080L01	COVER, filter, TDA
	3-138162	SCREW, tapping; 4-40 x 3/8"; 6 req'd.
	42-84284B02	RETAINER, color black; 4 req'd.
	15-82079L01	HOUSING
	42-84284B01	RETAINER, color scarlet; 2 req'd.
	42-10217A01	STRAP, cable harness; 2 req'd.
	46-84549F01	PLUG, polarizing

TFE6403A Harmonic Filter PL-4387-A

		CONNECTOR, receptacle:
J503, 504	9-84135B02	female, single contact
		COIL, RF:
	24-84288C13	4-1/8 turns
	24-84288C17	4-1/2 turns
	MECHANICAL PARTS	
	3-1438	SCREW, machine; 2-56 x 3/16"; 2 req'd.
	3-7164	SCREW, machine; 6-32 x 1/4"; 4 req'd.
	3-134186	SCREW, tapping; 6-32 x 5/16"; 2 req'd.
	3-84347C01	SCREW, set; 4 req'd.
	4-852094	WASHER, insulator; 4 req'd.
	15-84246C01	HOUSING, filter box
	15-84286C01	COVER, top; filter box
	15-84289C03	COVER, bottom
	74-84287C01	FORM, coil; 4 req'd.



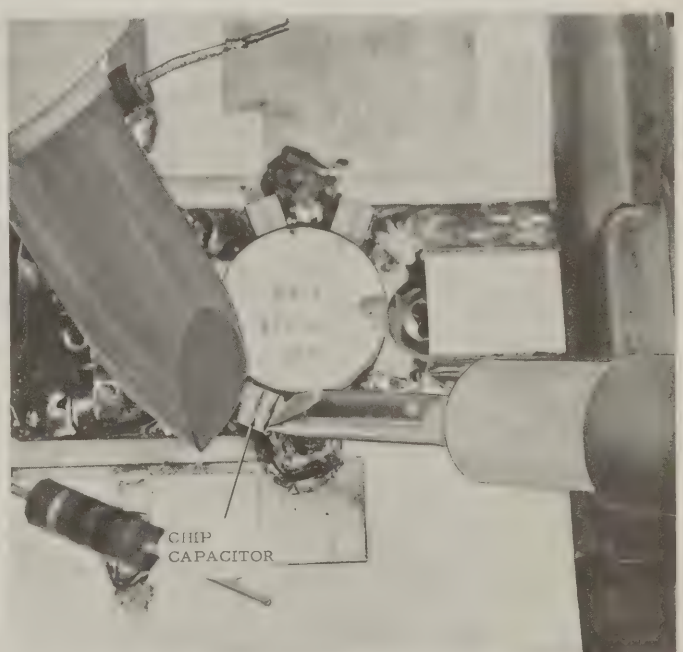
Step 2. Clean excess solder from the substrate.

Step 3. Using a tweezers, position the new capacitor. Heat the copper pad with the soldering iron and let solder flow onto one side of the capacitor. DO NOT touch the chip capacitor with the soldering iron. Repeat soldering on the opposite side.

Step 4. Check the substrate for cracks.

3.6 CABLE REPLACEMENT

Replace damaged or defective cables with new cable of the same length and part number.



FAEPS-15965-O

Figure 2. Chip Capacitor Removal Using Two Soldering Irons

TRN6573A Oscillator Mounting Kit PL-4415-A

		CAPACITOR, fixed: pF ±20%: 500 V: unless otherwise stated
C1, 3	21-83596E10	220
C2, 4	23-82601A34	2 uF +150-10%: 25 V
C5, 6	21-861219	.001 uF +100-0%
		COIL, rf:
L1	24-82835G21	3.7 uH
		CONNECTOR:
J6		includes:
	29-82335A01	CONTACT, male
	15-10183A63	INSULATOR, connector
NON-REFERENCE ITEMS		
	1-06708B28	CABLE ASSEMBLY #1 includes
	9-83208C02	SOCKET, channel element
	26-83193C03	SHEILD, channel element
	37-109120	GROMMET
	42-10217A02	CLAMP, cable harness
	1-06708B29	CABLE ASSEMBLY #2 includes:
	9-83208C02	SOCKET, channel element
	26-83193C03	SHIELD, channel element
	37-109120	GROMMET
	42-10217A02	CLAMP, cable harness
		CHASSIS ASSEMBLY, includes:
	7-06092H01	BRACKET, mounting
	9-6740	SOCKET, 8-contacts
		CAPACITORS C5 & C6
	42-10217A02	CLAMP, cable harness

TLD6383A Filter Helical PL-4421-O

		CAPACITOR, fixed:
C1	21-82355B09	33uF: ±5%, 500 V
		COIL, RF
L1	24-84418C02	3/8 turns
NON-REFERENCED ITEMS		
	3-134212	SCREW, tapping: 4-40 x 5/16; 16 req'd
	3-138081	SCREW, Set; 10-32 x 1-1/16; 3 req'd.
	7-84098K01	BRACKET, mounting
	9-82615F01	JACK, phono
	41-84410B01	SPRING, torque

TLD5491A Exciter PL-4422-O

		CAPACITOR, fixed: pF ±5%: 500 V unless otherwise stated
C401	21-831125	100 ±10%; 300 V
C402	21-82428B59	.01 uF +80-20%; 200 V
C403		NOT USED
C404	8-82905G11	.22 uF ±10%; 50 V
C405	21-83596E13	.001 uF ±10%; 100 V
C406	21-82428B59	.01 uF +80-20%; 200 V
C407, 408	23-84762H08	3.9 uF ±20%; 15 V
C409, 410	21-831125	100 ±10%; 300 V
C411	21-82372C03	0.1 uF +80-20%; 25 V
C412, 413	21-83596E10	220 ±20%
C414, 415	21-831125	100 ±10%; 300 V
C416, 417		NOT USED
C418 thru 421	23-84762H08	3.9 uF ±20%; 15 V
C422	21-82372C04	.05 uF +80-20%; 25 V
C423	21-83596E10	220 ±20%
C424, 425, 426	21-82372C04	.05 uF +80-20%; 25 V
C427	21-83406D51	3 ±0.25 pF
C428	21-82133G06	27: 500 V
C429	21-82428B59	.01 uF +80-20%; 200 V
C430	21-84494B07	150
C431	21-83406D54	4 ±0.25 pF
C432	21-84494B16	330
C433	21-84494B13	240
C434, 435		NOT USED
C436	21-82428B59	.01 uF +80-20%; 200 V
C437	21-83596E13	.001 uF ±10%; 100 V
C438	21-84494B01	51
C439	21-861453	1.5 ±10%
C440	21-852322	62
C441	21-84494B10	190
C442, 443	21-82428B59	.01 uF +80-20%; 200 V
C444	21-84493B27	51: 200 V
C445	21-83406D91	40
C446	21-82450B06	0.75 ±10%
C447	21-83596E13	.001 uF ±10%; 100 V
C448	21-83406D92	36
C449	21-84493B31	57: 200 V
C450	21-83596E13	.001 uF ±10%; 100 V
C451	21-82428B59	.01 uF +80-20%; 200 V
C452	21-83406D93	16
C453	21-83406D81	20
C454	21-82450B06	0.75 ±10%
C455	21-83596E13	.001 uF ±10%; 100 V
C456	21-83406D90	11
C457	21-83406D89	10 ±0.5 pF
C458	21-83596E13	.001 uF ±10%; 100 V
C459	21-840365	24: NPO
C460	21-83596E10	220 ±20%
C461	21-84494B07	150
C462, 463	21-83596E13	.001 uF ±10%; 100 V
C464	21-82355B62	1.0
C465	21-82428B59	.01 uF +80-20%; 200 V
C466	21-82428B28	.002 uF ±10%
C467	21-82187B07	470 ±10%
C468	21-82610C23	6.8 ±0.5; 200 V
		DIODE: (SEE NOTE)
CR401	48-863030	germanium
CR402, 403		NOT USED
CR404, 405	48-82139G01	germanium
		COIL, rf:
E401	24-84392B06	40 turns on 820 ohm resistor
E402	24-84392B13	15 turns on 560 ohm resistor
		CONNECTOR, receptacle:
J401		NOT USED
J402	9-84207B01	7 contacts
		COIL, rf:
L401	24-84389B02	18-2/3 turns: coded Black
L402	24-84389B01	18-1/2 turns; coded Yellow
L403	24-84389B06	8-2/3 turns; coded Green
L404	24-84389B05	8-1/2 turns; coded Red
L405, 406	24-84972A09	6-1/2 turns; coded Yellow
L407, 408	24-84972A11	3-1/2 turns; coded Green
L409		NOT USED
L410	24-80900A61	0.62 mH
L411, 412	24-82835G08	2.6 uH; coded Red-Blue-Gold
L413	24-84923C01	1-1/2 turns
		CONNECTOR, plug:
P401		part of printed circuit board
P402	28-84282D01	phono
P403, 902		part of printed circuit board
		TRANSISTOR: (SEE NOTE)
Q401	48-869642	NPN; type M9642
Q402, 403		NOT USED
Q404	48-869571	PNP; type M9571
Q405	48-869534	NPN; type M9534
Q406	48-869390	NPN; type M9390
Q407, 408	48-869867	NPN; type M9867
		RESISTOR, fixed: ±10% 1/4 W unless otherwise stated
R401	6-124C43	560
R402	6-124A37	330 ±5%
R403	6-124A79	18k ±5%
R404	6-124A87	39k ±5%
R405	6-124A85	33k ±5%
R406	6-124A99	120k ±5%
R407	6-124B04	180k ±5%
R408	6-124C73	10k
R409	6-124C83	27k
R410	18-83083G24	variable: 25k ±30%
R411 thru 418		NOT USED
R419 thru 422	6-124A79	18k ±5%
R423	6-124C57	2.2k
R424	6-124C85	33k
R425	6-124C51	1.2k
R426	6-124C47	820
R427		NOT USED
R428	6-124C85	33k
R429	6-124C57	2.2k
R430	6-124C35	270
R431	6-124C89	47k
R432	6-124C63	3.9k
R433		NOT USED
R434	6-124C39	390
R435	6-124C09	22
R436	6-125C05	15; 1/2 W
R437	6-124C97	100k
R438	6-124C49	1k
R439	6-124C49	1k
		SYMMETRICAL CLIPPER AND SPLATTER FILTER:
U401	1-80763B05	potted unit
NON-REFERENCED ITEMS		
	14-861196	INSULATOR, transistor: 2 req'd. (used with Q407 & Q408)
	26-83379H01	HEAT SINK (used with Q408)
	26-84598A01	SHIELD, coil; 4 req'd. (used with L405 thru L408)
	26-84598A02	SHIELD, coil; 4 req'd. (used with L401 thru L404)
	42-84284B01	RETAINER: 4 req'd.
	3-138162	SCREW, tapping: Phillips round hd., 4-40 x 3/8": 4 req'd. (used for mounting Retainers)
	55-84300B01	HANDLE
	30-83794C01	CABLE, coaxial; 6" req'd. (used with P402)
	29-84028H01	TERMINAL, pin; 19 req'd.
	29-84028H02	TERMINAL, pin; 12 req'd.
	29-855943	TERMINAL, pin; 16 req'd.
	39-10184A10	CONTACT, terminal; 10 req'd.

NOTE: For optimum performance, replacement diodes and transistors must be ordered by Motorola part numbers.

PARTS LIST

TRN6584A Chassis and Hardware Kit — PL-4382-A

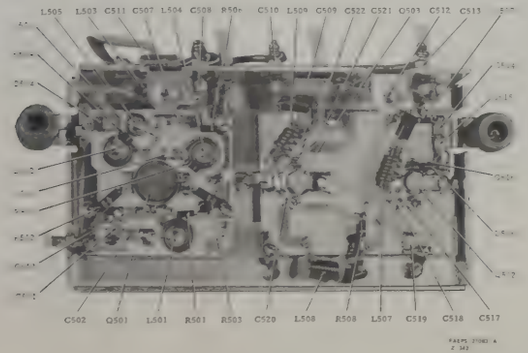
	-7511C01	CAPACITOR, fixed: RFI, filter
	[illegible]	[illegible]
	91-87511C01	RFI, filter
512	23-82783B25	4.7 uF ±10%, 25 V
	91-87511C01	RFI, filter
		CONNECTOR, receptacle:
	28-84282D01	male; single contact
	[illegible]	[illegible]
	28-84282D01	male; single contact
		Includes:
	15-83498F05	INSULATOR, 5-circuit
		MECHANICAL PARTS
	7-82083L01	BRACKET
	15-82060L01	COVER, filter, TDA
	3-138162	SCREW, tapping, 4-40 x 3/8", 6 req'd.
	42-84284B02	RETAINER, color black, 4 req'd.
	15-82079L01	HOUSING
	42-84284B01	RETAINER, color scarlet; 2 req'd.
	42-10217A01	STRAP, cable harness, 2 req'd.
	46-84549F01	PLUG, polarizing

TRN6603A Harmonic Filter — PL-4387-A

4	9-84135B02	CONNECTOR, receptacle: female, single contact
		COIL, RF:
	24-84288C13	4-1/8 turns
	24-84288C17	4-1/2 turns
		MECHANICAL PARTS
	1-1438	SCREW, machine, 2-56 x 3/16", 2 req'd.
	3-7364	SCREW, machine, 6-32 x 1/4", 4 req'd.
	3-134186	SCREW, tapping, 6-32 x 5/16", 2 req'd.
	147C01	SCREW, set, 4 req'd.
	[illegible]	WASHER, insulator; 4 req'd.
	[illegible]	HOUSING, filter box
	15-84269C03	COVER, bottom
	46-84287C01	FORM, coil, 4 req'd.

TLF6033A Tripler and Doubler — PL-4489-0

		CAPACITOR, fixed: pF ±.25 pF 50 V, unless otherwise stated
	21-84873H65	47 ±5%
C502	21-84873H17	56 ±10%
C503	21-84873H45	47 ±5%
C504	21-84873H01	2.2 uF ±10%
C505	21-84736E28	4.7
C506	21-84736E26	2.7
C507	21-84736E27	3.3; 500 V
C514	21-84873H17	56 ±10%
C515	21-84736E08	10 ±5%
C516	21-84736E30	10 ±.5 pF
C517	21-84736E24	3.3
[illegible]	[illegible]	[illegible]
C519	21-84736E15	12
C520	21-84736E28	4.7
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	COIL, RF: part of microstrip plating
[illegible]	24-82000E25	blue, color code
[illegible]	[illegible]	part of microstrip plating
[illegible]	[illegible] 23H04	choke 290 uH
[illegible]	[illegible] 2000E25	blue, color code
[illegible]	[illegible] 3856C05	9-1/2 turns (white)
[illegible]	[illegible] 82000E25	blue, color code
[illegible]	[illegible]	[illegible]
[illegible]	48-869690	TRANSISTOR, (SEE NOTE): NPN, type M9690
[illegible]	48-869916	NPN, type M9916
[illegible]	48-869917	NPN, type M9917
[illegible]	[illegible]	RESISTOR, fixed: ±10%; 1/8 W; unless otherwise stated
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
		MECHANICAL PARTS
	2-84628A03	NUT, transistor mounting; 3 req'd.
	3-7467	SCREW, tapping; 8-18 x 3/8"; 2 req'd.
	14-82649K02	INSULATOR
	76-83960B01	CORE, ferrite
	76-84069B01	FERRITE BEAD, 2 req'd.
	84-83702K05	MICROSTRIP, tripler
	84-82094L01	MICROSTRIP, doubler



FAEPS-21061-A

1. DESCRIPTION

The TLF1053A Tripler and Doubler consists of a TFE6403A Bandpass Filter, a TLF6033A Tripler/Doubler Amplifier, and a TRN6584A Chassis and Hardware Kit. It employs discrete components and microstrips.

2. FUNCTIONAL OPERATION

The filtered output from the exciter/first bandpass filter is accepted by the tuned circuit input of the tripler/doubler and applied to tripler stage Q501. The tripled signal is then passed through TFE6403A Series Bandpass Filter which passes the multiplied signal and attenuates harmonics outside the passband. The signal is then applied to doubler Q502. The multiplied signal is amplified by Q503 and applied to the input of the intermediate power amplifier.

3. MAINTENANCE

CAUTION

The tripler and doubler is composed of discrete components and hybrid microstrip circuitry. To prevent damage to the microstrip substrate, extreme care must be exercised when servicing this board.

3.1 VISUAL INSPECTION

Most problems occurring in the tripler and doubler section of the board can be detected by performing the following visual checks:

- --check for broken leads and cracked substrates (see paragraph 3.2),
- --check for leached capacitors,
- --check spiral coils to insure that excessive solder has not shorted the plate loops,
- --check the feed choke leads - they should not short out against the cover screws,
- --check solder joints on the doubler and low level amplifier leads.

3.2 CRACKED SUBSTRATE TEST

If visual inspection does not isolate a defective component, perform the following substrate test.

Step 1. Paint the substrate sparingly with "zyglo".

Step 2. Rinse off the "zyglo" with isopropyl alcohol.

Step 3. Place the substrate under an ultraviolet light source. Again, rinse the substrate with isopropyl alcohol. Any areas where the zyglo will not rinse away will glow yellow-green, indicating a cracked substrate (substrate borders will always glow due to seepage around the edges).

Step 4. If the substrate shows a crack, replace the tripler and doubler.

3.3 REMOVAL AND INSERTION

Remove the tripler and doubler as follows. Extreme care must be used to protect against damage to the substrate.

Step 1. Unscrew the slotted screw on the intermediate power amplifier (IPA) heatsink. Rotate the top of the heatsink out and downward until it rests on its hinge. Disconnect the input and power cables. Lift the IPA out of its mounting bracket and disconnect the output cable.

Step 2. Remove the IPA mounting bracket by removing the three Phillips screws on top of the bracket. Pull the top of the bracket out first.

Step 3. Unscrew the two upper red and lower black retainer screws. Disconnect the power cable and pull the tripler and doubler from the unichassis. Disconnect the input cable.

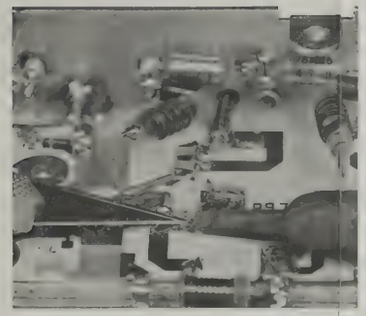
To replace the tripler and doubler, reverse the above procedure.

3.4 TRANSISTOR REPLACEMENT

Step 1. Remove the nut on the stud side of the defective transistor.

Step 2. Unsolder any chokes which make soldering and removal difficult.

Step 3. One at a time, heat the transistor leads until they can be bent away from the substrate with a small knife blade (see figure 1). Do not apply any pressure to the substrate. Be careful not to touch chip capacitors with the soldering iron as they can easily become leached. After the lead is bent up, remove any excess solder which connects it to the substrate. Lift the transistor off the substrate.



FAEPS-21091-A

Figure 1. Transistor Removal

Step 4. Remove excess solder from the substrate pads.

Step 5. Insert the new transistor and tighten the stud nut (do not overtighten as this may crack the substrate).

Step 6. Form the transistor leads to conform to the substrate pads. Center the leads on the pads and carefully solder them to the substrate. Solder the entire lead, being careful not to apply too much pressure.

Step 7. Check the substrate for cracks.

3.5 CHIP CAPACITOR REPLACEMENT

Step 1. Two soldering irons are needed for this procedure. Place the soldering irons on each side of the chip capacitor. When the solder melts, lift the capacitor from the board (see figure 2).

Step 2. Clean excess solder from the substrate.

Step 3. Using a tweezers, position the new capacitor. Heat the copper pad with the soldering iron and let solder flow onto one side of the capacitor. DO NOT touch the chip capacitor with the soldering iron. Repeat soldering on the opposite side.

Step 4. Check the substrate for cracks.

3.6 CABLE REPLACEMENT

Replace damaged or defective cables with new cable of the same length and part number.

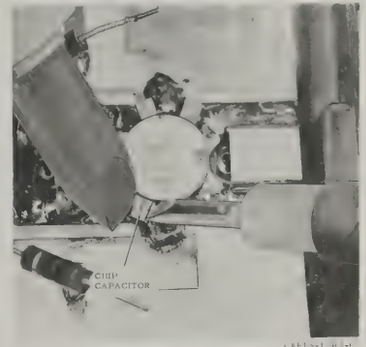
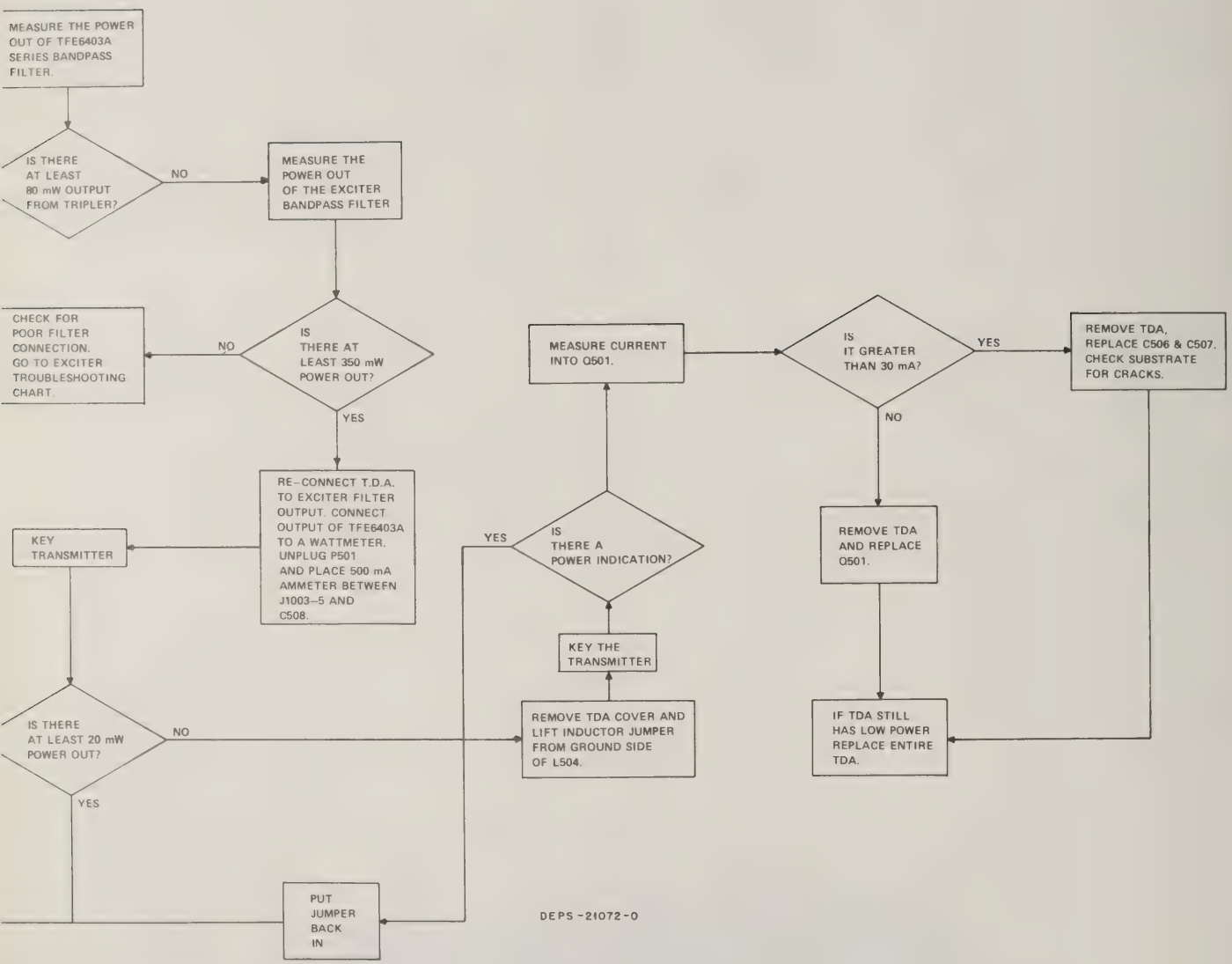


Figure 2. Chip Capacitor Removal Using Two Soldering Irons


MEASURE THE POWER OUT OF TFE6403A SERIES BANDPASS FILTER.
IS THERE AT LEAST 80 mW OUTPUT FROM TRIPLER?
NO
MEASURE THE POWER OUT OF THE EXCITER BANDPASS FILTER
CHECK FOR POOR FILTER CONNECTION. GO TO EXCITER TROUBLESHOOTING CHART.
NO
IS THERE AT LEAST 350 mW POWER OUT?
YES
RE-CONNECT T.D.A. TO EXCITER FILTER OUTPUT. CONNECT OUTPUT OF TFE6403A TO A WATTMETER. UNPLUG P501 AND PLACE 500 mA AMMETER BETWEEN J1003-5 AND C508.
KEY TRANSMITTER
IS THERE AT LEAST 20 mW POWER OUT?
NO
YES
PUT JUMPER BACK IN
YES
IS THERE A POWER INDICATION?
KEY THE TRANSMITTER
REMOVE TDA COVER AND LIFT INDUCTOR JUMPER FROM GROUND SIDE OF L504.
MEASURE CURRENT INTO Q501.
IS IT GREATER THAN 30 mA?
YES
REMOVE TDA, REPLACE C506 & C507. CHECK SUBSTRATE FOR CRACKS.
NO
REMOVE TDA AND REPLACE Q501.
IF TDA STILL HAS LOW POWER REPLACE ENTIRE TDA.

DEPS-21072-0

INTERMEDIATE POWER AMPLIFIER

MODEL TLF1063B

TLF1063B INTERMEDIATE POWER AMPLIFIER MODEL COMPLEMENT

MODEL	DESCRIPTION
TRN6982A	Heat Sink and Hardware Kit
TLF6213A	Control Amplifier
TLF6223A	Second Amplifier
TKN6940A	Power Amplifier Cable (15 watt)

1. TLF1063B INTERMEDIATE POWER AMPLIFIER FUNCTIONAL OPERATION

(Refer to diagram PEPS-25082)

The TLF1063B Intermediate Power Amplifier is a two stage unit consisting of a control stage and a driver stage. The gain of the IPA is controlled by the power control board via the directional coupler. Output signals are sampled by the power control board, which reduces or increases the drive to IPA driver stage Q702. The IPA is protected against overdriving and high VSWR by the power control board. The output of the IPA (approximately 15 watts) is applied through a directional coupler to the 125-watt power amplifier.

2. IPA POWER SETTING PROCEDURE

NOTE

If the transmitter is to be brought back up to rated power after turning down the POWER SET control for alignment or troubleshooting procedure, proceed directly to step 4.

STEP	ADJUST	METERING PLUG LOCATION	TEST SET SELECTOR SWITCH POSITION	METER REV. SWITCH & REF. A-B SWITCH	STAGE AND PROCEDURE
1	Power Set and Drive	Power Control Board	Wattmeter		Pre-setting of Controls: Adjust the drive limit control fully counterclockwise (maximum drive). Adjust the Power Set Control fully clockwise (near maximum power output). Connect a wattmeter and load to the directional coupler rf output connector and remove the shield from over the power control board.
2	Drive Limit	Power Control Board	Wattmeter		Key Transmitter. Adjust drive limit (R609 on power control board) until a power output of 20 watts is obtained. If the maximum power output is between 17 and 20 watts, set the drive limit wide open. Unkey the transmitter and replace shield.
3	Power Set	Power Control	Wattmeter		Key the transmitter. Adjust the power set control (R607 on power control board) until power output is within the station licensing parameters (see Figures 1 & 2). Unkey the

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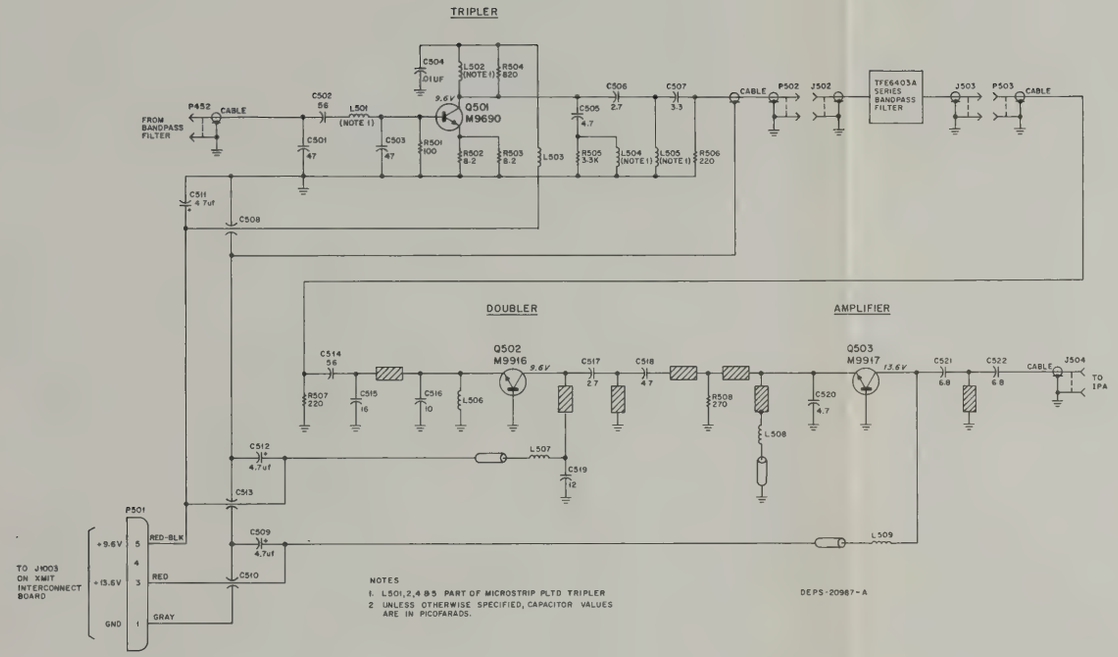

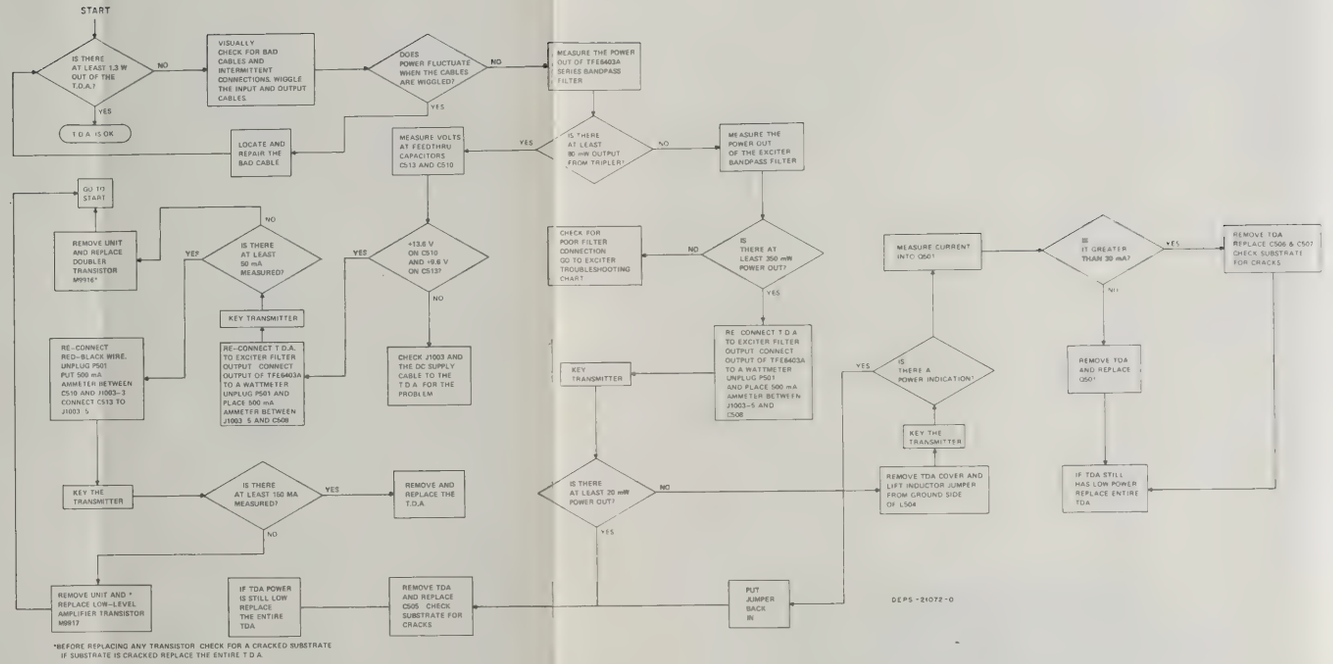
START
IS THERE AT LEAST 1.3 W OUT OF THE T.D.A.?
NO
YES
T.D.A. IS OK
VISUALLY CHECK FOR BAD CABLES AND INTERMITTENT CONNECTIONS. WIGGLE THE INPUT AND OUTPUT CABLES
DOES POWER FLUCTUATE WHEN THE CABLES ARE WIGGLED?
NO
YES
LOCATE AND REPAIR THE BAD CABLE
MEASURE THE POWER OUT OF TFE6403A SERIES BANDPASS FILTER
MEASURE VOLTS AT FEEDTHRU CAPACITORS C513 AND C510
IS THERE AT LEAST 80 mW OUTPUT FROM TRIPLER?
YES
NO
MEASURE THE POWER OUT OF THE EXCITER BANDPASS FILTER
GO TO START
REMOVE UNIT AND REPLACE DOUBLER TRANSISTOR M9916*
IS THERE AT LEAST 50 mA MEASURED?
NO
YES
+13.6 V ON C510 AND +9.6 V ON C513?
YES
NO
CHECK FOR POOR FILTER CONNECTION GO TO EXCITER TROUBLESHOOTING CHART
IS THERE AT LEAST 350 mW POWER OUT?
NO
YES
MEASURE CURRENT INTO Q501
IS IT GREATER THAN 30 mA?
YES
NO
REMOVE T.D.A. REPLACE C506 & C507 CHECK SUBSTRATE FOR CRACKS
KEY TRANSMITTER
RE-CONNECT RED-BLACK WIRE. UNPLUG P501 PUT 500 mA AMMETER BETWEEN C510 AND J1003-3 CONNECT C513 TO J1003-5
RE-CONNECT T.D.A. TO EXCITER FILTER OUTPUT CONNECT OUTPUT OF TFE6403A TO A WATTMETER UNPLUG P501 AND PLACE 500 mA AMMETER BETWEEN J1003-5 AND C508
CHECK J1003 AND THE DC SUPPLY CABLE TO THE T.D.A. FOR THE PROBLEM
KEY TRANSMITTER
RE CONNECT T.D.A TO EXCITER FILTER OUTPUT CONNECT OUTPUT OF TFE6403A TO A WATTMETER UNPLUG P501 AND PLACE 500 mA AMMETER BETWEEN J1003-5 AND C508
IS THERE A POWER INDICATION?
YES
NO
KEY THE TRANSMITTER
REMOVE T.D.A. AND REPLACE Q501
KEY THE TRANSMITTER
IS THERE AT LEAST 150 MA MEASURED?
YES
NO
REMOVE AND REPLACE THE T.D.A.
IS THERE AT LEAST 20 mW POWER OUT?
NO
YES
REMOVE T.D.A. COVER AND LIFT INDUCTOR JUMPER FROM GROUND SIDE OF L504
IF T.D.A. STILL HAS LOW POWER REPLACE ENTIRE T.D.A.
REMOVE UNIT AND * REPLACE LOW-LEVEL AMPLIFIER TRANSISTOR M9917
IF T.D.A. POWER IS STILL LOW REPLACE THE ENTIRE T.D.A.
REMOVE T.D.A. AND REPLACE C505 CHECK SUBSTRATE FOR CRACKS
PUT JUMPER BACK IN
DEPS-21072-O

*BEFORE REPLACING ANY TRANSISTOR CHECK FOR A CRACKED SUBSTRATE IF SUBSTRATE IS CRACKED REPLACE THE ENTIRE T.D.A.

TLF1053A Tripler and Doubler
Schematic Diagram and Troubleshooting Chart
Motorola No. PEPS-21097-O
12/18/76-NPC

INTERMEDIATE POWER AMPLIFIER

MODEL TLF1063B

TLF1063B INTERMEDIATE POWER AMPLIFIER MODEL COMPLEMENT

MODEL	DESCRIPTION
TRN6982A	Heat Sink and Hardware Kit
TLF6213A	Control Amplifier
TLF6223A	Second Amplifier
TKN6940A	Power Amplifier Cable (15 watt)

1. TLF1063B INTERMEDIATE POWER AMPLIFIER FUNCTIONAL OPERATION

(Refer to diagram PEPS-25082)

The TLF1063B Intermediate Power Amplifier is a two stage unit consisting of a control stage and a driver stage. The gain of the IPA is controlled by the power control board via the directional coupler. Output signals are sampled by the power control board, which reduces or increases the drive to IPA driver stage Q702. The IPA is protected against overdriving and high VSWR by the power control board. The output of the IPA (approximately 15 watts) is applied through a directional coupler to the 125-watt power amplifier.

2. IPA POWER SETTING PROCEDURE

NOTE

If the transmitter is to be brought back up to rated power after turning down the POWER SET control for alignment or troubleshooting procedure, proceed directly to step 4.

STEP	ADJUST	METERING PLUG LOCATION	TEST SET SELECTOR SWITCH POSITION	METER REV. SWITCH & REF. A-B SWITCH	STAGE AND PROCEDURE
1	Power Set and Drive	Power Control Board	Wattmeter		Pre-setting of Controls: Adjust the drive limit control fully counterclockwise (maximum drive). Adjust the Power Set Control fully clockwise (near maximum power output). Connect a wattmeter and load to the directional coupler rf output connector and remove the shield from over the power control board.
2	Drive Limit	Power Control Board	Wattmeter		Key Transmitter. Adjust drive limit (R609 on power control board) until a power output of 20 watts is obtained. If the maximum power output is between 17 and 20 watts, set the drive limit wide open. Unkey the transmitter and replace shield.
3	Power Set	Power Control	Wattmeter		Key the transmitter. Adjust the power set control (R607 on power control board) until power output is within the station licensing parameters (see Figures 1 & 2). Unkey the

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STEP	ADJUST	METERING PLUG LOCATION	TEST SET SELECTOR SWITCH POSITION	METER REV. SWITCH & REF. A-B SWITCH	STAGE AND PROCEDURE
					transmitter. On multi-frequency radios, check drive limit on both channels. If necessary, readjust Drive Limit control so the lowest power channel is set to 20 watts. If the Drive Limit control cannot obtain a high enough reading, set it fully counterclockwise (minimum drive limit). Unkey transmitter.
4	Power Set	Power Control Board	Wattmeter		Power Set: Key transmitter. Adjust the Power Set control CCW and set power output per Table 3 under Power Set. On Multi-frequency radios, check power output on all channels. If necessary, readjust Power Set so the lowest power channel is set per Table 3 under Power Set. Unkey transmitter. This completes the IPA power setting procedure.
5	Filament Voltage	P. A.	Voltmeter		Verify standby filament voltage of 6.3 V dc. Key exciter - IPA and verify that filament voltage drops to 5.0 V dc. Readjust as necessary with controls located on the power supply regulator board.

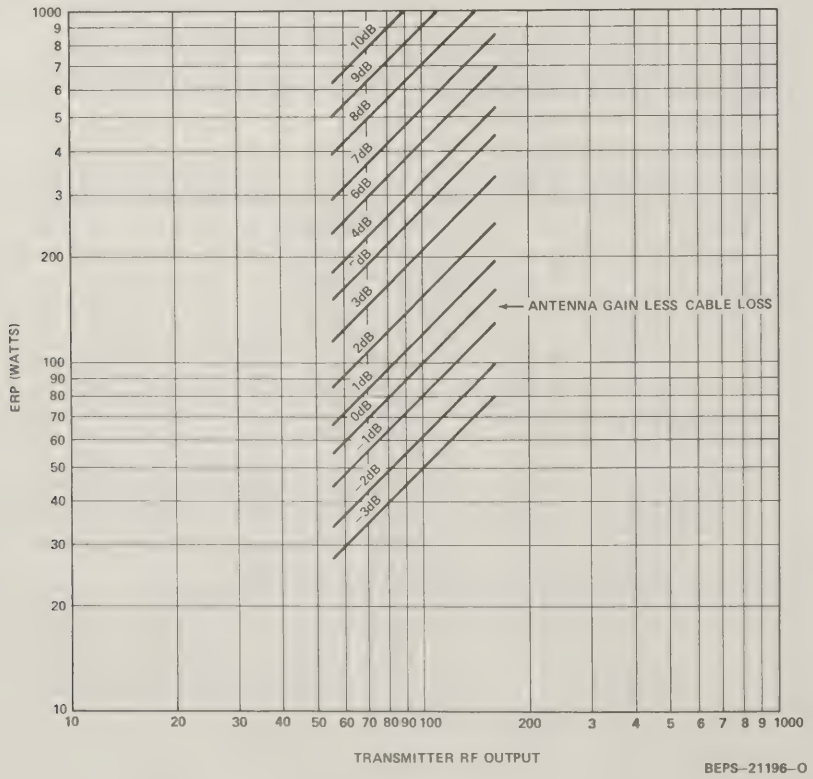


Figure 1. Effective Radiated Power

3. MAINTENANCE AND TROUBLESHOOTING

To determine if the IPA is operating properly, attach a wattmeter and a 50 ohm load to the directional coupler output.

Step 1. Key the station. Turn the power set control (R607) fully clockwise and the drive limit control (R609) fully counterclockwise (located on power control board and viewed from front of station). If power output is less than 17 watts, measure controlled A+ and A+ (blue and red wires respectively) at the IPA feed through terminals.

Step 2. If both of these voltages are greater than 12 volts, check input power by attaching a wattmeter and 50 ohm load to the tripler and doubler (be sure to de-key the station while the stage tripler and doubler is unloaded). If power is less than 1.4 watts, see sections 68P81031E56 and 68P81031E54 for tripler and doubler and exciter test procedures.

Step 3. If both controlled A+ and A+ are less than 12 volts, check fuse F1.

Step 4. If controlled A+ is less than 12 volts and A+ greater than 12 volts, check C902 on the unified chassis and the power control board (section 68P81031E59).

Step 5. If steps 1 through 4 have not isolated a malfunction, the fault is within the IPA. Insert a wattmeter between the tripler and doubler and the IPA. Key the station and measure the ratio of forward to reflected power. If this ratio is less than 7 to 1, the IPA input VSWR is too high. Check the input cables for breaks and/or shorts and the chip capacitors for signs of leaching. If chip capacitors and cables show no defects, replace the input stage (TLF6213A). If cables need replacement use kit (TKN6940A).

Step 6. If input VSWR is acceptable, turn the station off and remove the wire between the first and second stages. Connect a cable from the output of the Control stage to a wattmeter and 50 ohm load. Turn station on. After transmitter is enabled, key the transmitter. If power out of the first stage is less than 5 watts, the first stage must be replaced. If power is greater than 5 watts, check C706, C707, C708, C709, C717, and C718 for leaching and replace as necessary.

Step 7. Replace the wire removed in Step 6. Monitor the power output (see Step 1). If power output is still less than 17 watts, replace the output stage (TLF6223A).

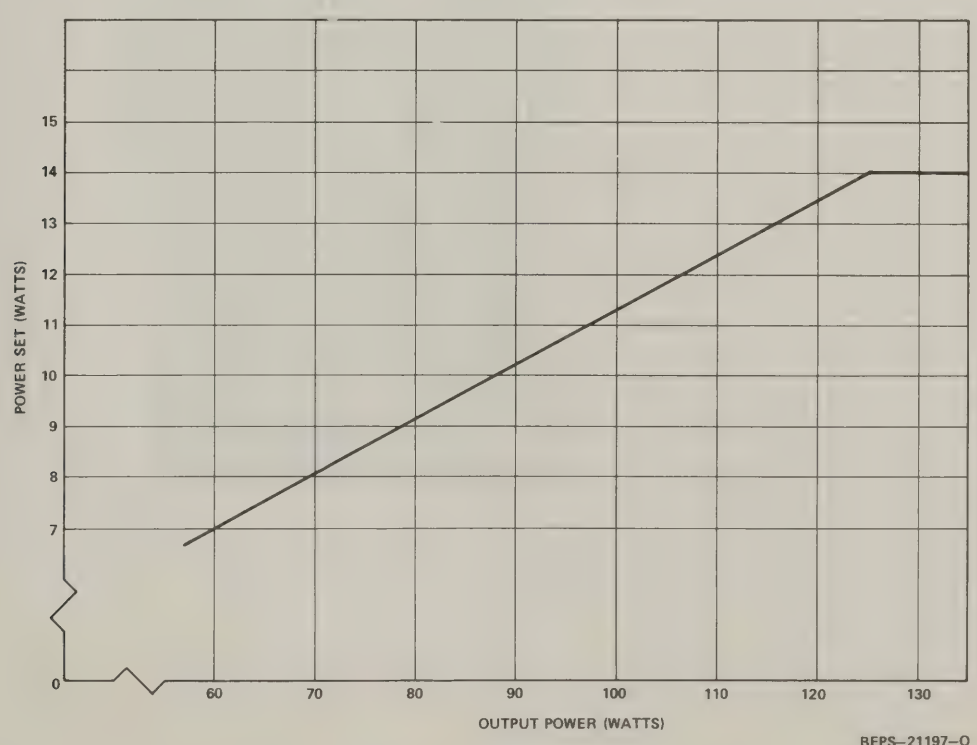
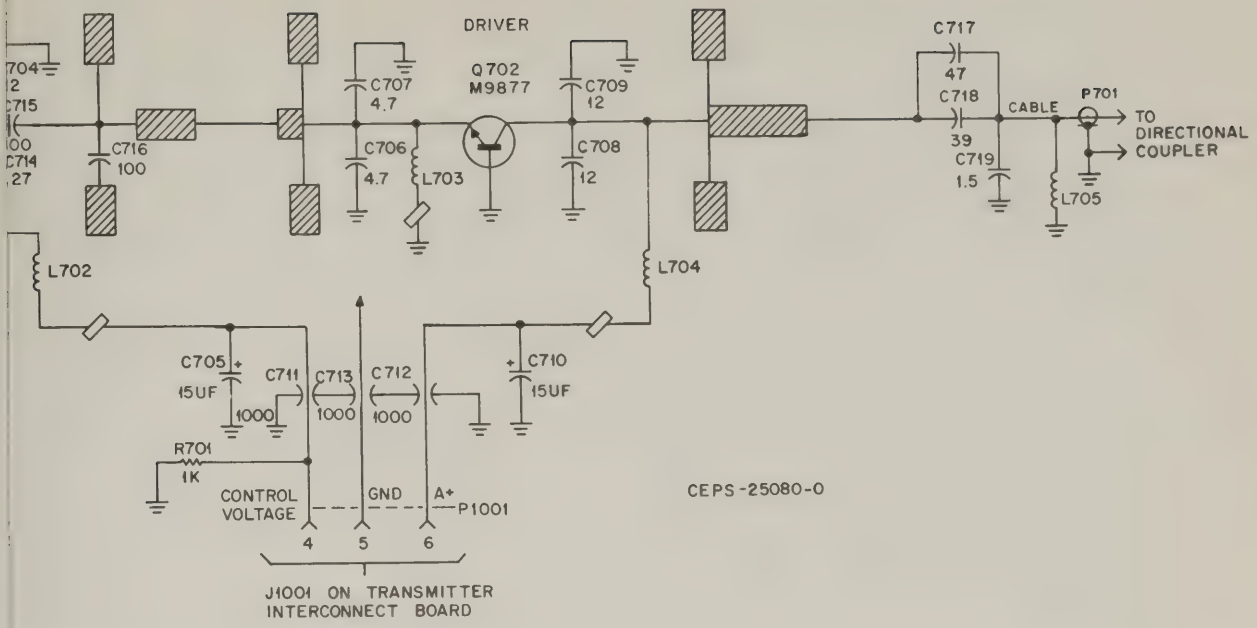
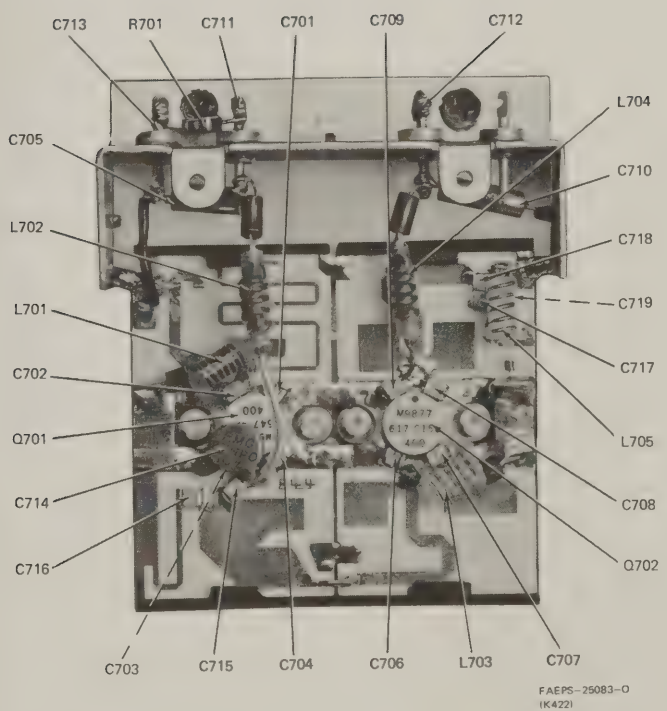


Figure 2. IPA Power Output





TLF1063B Intermediate Power Amplifier
Schematic Diagram
Motorola No. PEPS-25082-O
3/30/78-NPC

TRN6982A Heat Sink and Hardware Kit PL-5687-O

		CAPACITOR, fixed:
C705, 10	23-82783B24	15 uF ±20%; 25 V
C714	21-410089	27 pF ±10%; 500 V
C719	21-82450B13	1.5 pF ±5%; 500 V
		COIL, rf:
L701	24-83884G04	7-1/2 turns; coded
L702	24-82000E25	coded blue
L703	24-83884G06	4-1/2 turns; coded white
L704	24-82000E25	coded blue
L705	24-83884G06	4-1/2 turns; coded white
		RESISTOR, fixed:
R701	6-124C49	1k ±10%; 1/4 W
	NON-REFERENCED ITEMS	
	1-80775B31	COVER ASSEMBLY includes:
	15-82651K01	COVER, PA
	3-118030	SCREW, machine: 10-32 x 1"; 2 used
	3-134186	SCREW, tapping: 6-32 x 5/16"; 2 used
	3-135980	SCREW, tapping: 10-32 x 1/2"; 2 used
	3-138162	SCREW, tapping: 4-40 x 3/8"; Phillips round head; 8 used
	3-138813	SCREW, machine: 4-40 x 3/8"; Phillips fillister head; 4 used
	26-82831K01	HEAT SINK
	42-10128A10	RING, retaining: 8 used
	43-82252H01	BUSHING; 2 used
	76-83960B01	FERRITE BEAD: .118" long; 3 used
	76-84069B01	FERRITE BEAD: .236 long; 2 used

TLF6213A Control Amplifier PL-5688-O

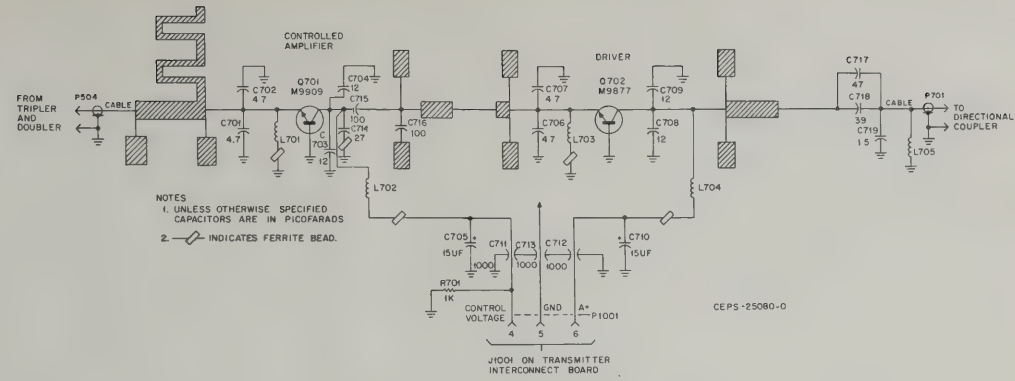
		CAPACITOR, fixed: pF ±5%; 50 V:
C701, 702	21-84736E19	4.7 ±.25 pF
C703, 704	21-84736E15	12
C715, 716	21-84736E21	100
		TRANSISTOR:
Q701	-	For replacement, order entire TLF6213A Kit.
	NON-REFERENCED ITEMS	
	1-80796E71	MICROSTRIP; input
	1-80796B72	MICROSTRIP; output includes: CAPACITORS C715, C716
	42-84417K01	HOLDER, substrate
	64-84255K01	PLATE, ground strap

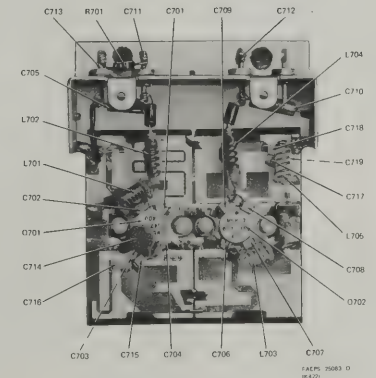
TLF6223A Second Amplifier PL-5689-O

		CAPACITOR, fixed: pF ±5%; 50 V; unless otherwise stated
C706, 707	21-84736E19	4.7 ±.25 pF
C708, 709	21-84736E15	12
C717	21-84736E22	47
C718	21-84736E12	39
		TRANSISTOR:
Q702	-	For replacement, order entire TLF6223A Kit.
	NON-REFERENCED ITEMS	
	1-80796B73	MICROSTRIP; input
	1-80796B74	MICROSTRIP; output includes: CAPACITORS C717, C718
	42-84417K01	HOLDER, substrate
	64-84255K01	PLATE, ground strap

TKN6940A RF Cable Kit PL-5690-O

C711, 112, 113	21-861219	CAPACITOR, fixed: 1000 pF; 500 V (feedthru)
		CONNECTOR, plug:
P504, 701	28-83099K01	Coaxial, BNC: 50 ohm
P1001	-	includes
	15-83498F07	INSULATOR, connector: 6-contact
	29-83499F01	CONTACT, terminal: 3 used
	46-84549F01	PLUG, polarizing
	NON-REFERENCED ITEMS	
	1-80796B69	CABLE ASSEMBLY, 7.5" includes:
	30-83794C01	CABLE, coaxial; 7.5" long CONNECTOR P504
	1-80796B70	CABLE ASSEMBLY includes:
	30-83794C01	CABLE, coaxial: 8" long CONNECTOR P701
	1-80797B24	BRACKET ASSEMBLY includes:
	1-80788B48	BRACKET SUBASSEMBLY includes:
	7-82053L01	BRACKET, mounting CAPACITORS C711, C712, C713
	1-80788B49	CABLE ASSEMBLY includes:
	42-10217A02	STRAP, cable harness: 2 used CONNECTOR P1001





TLF1063B Intermediate Power Amplifier
Schematic Diagram
Motorola No. PEPS-25082-O
3/30/78-NPC

DIRECTIONAL COUPLER

MODEL TLF6133A

1. FUNCTIONAL OPERA

The TLF6133A Direction
both forward and reverse pow
diate power amplifier. A sam
reverse power is detected by
and sent, as a dc control volt
control board. The power co
these voltages to control the d
and thus the output of the tran
diagram BEPS-20989.

2. MAINTENANCE AND

The directional coupler c
rostrip circuitry and should b
repairable item. Should the f
indicate a fault, replace the e

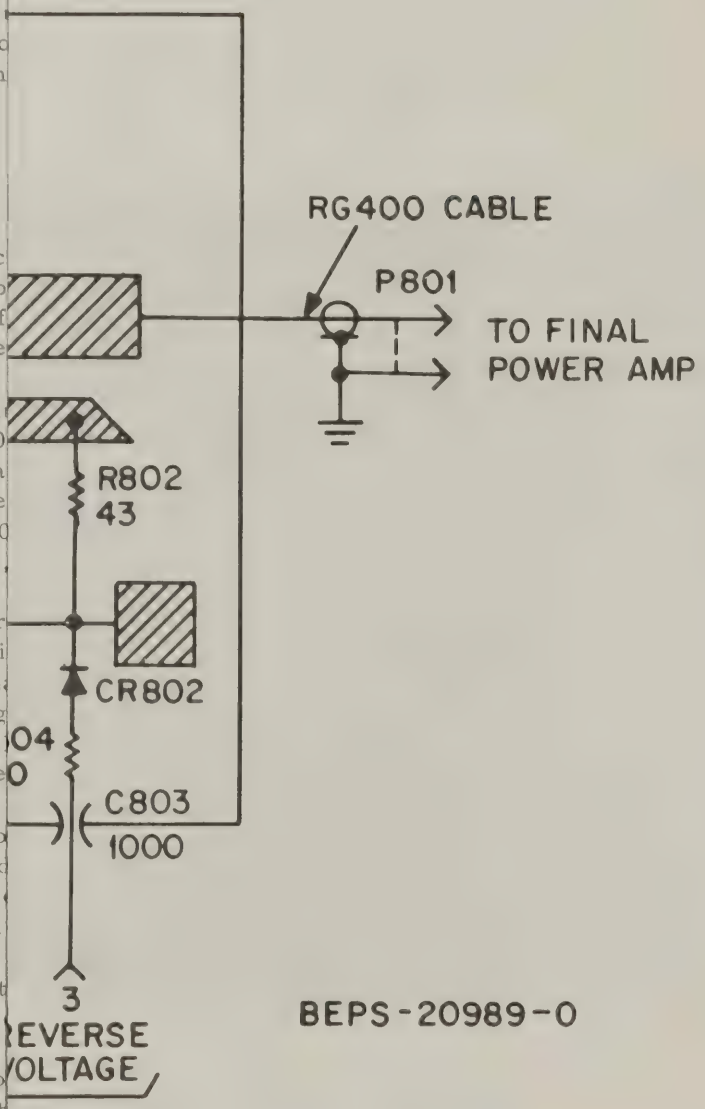
Step 1. Unplug J1000. Usi
place the negative lead on J10
tive lead on J1000-5. The rea
er than 5 megohms. Reverse
reading should be less than 50
ings are not within this range,

Step 2. Using an ohmmeter
lead on J1000-1 and the positi
The reading should be less th
verse the leads. The reading
greater than five megohms.
within this range, replace the

Step 3. Connect J1000. Ap
the coupler into a 50 ohm load
the voltage at J1000-1 (with r
sis). Measure the voltage on
respect to the chassis). The
should be at least 1 volt great
If this does not occur, replac

Step 4. Apply 14 watts thro
coupler to a wattmeter, short
ohm load (in that order). Adju
reflection. Measure the volta
J1000-1. The voltage at J1000
±1 volt of that at J1000-1. If
replace the board.

Step 5. Using the shorting
reflected power while monito
J1000-3. If the voltage does
place the board.



PARTS LIST SHOWN
ON BACK OF THIS SHEET

1. FUNCTIONAL OPERATION

The TLF6133A Directional Coupler samples both forward and reverse power of the intermediate power amplifier. A sample of forward and reverse power is detected by CR801 and CR802 and sent, as a dc control voltage, to the power control board. The power control board uses these voltages to control the output of the IPA and thus the output of the transmitter. Refer to diagram BEPS-20989.

2. MAINTENANCE AND TROUBLESHOOTING

The directional coupler contains hybrid microstrip circuitry and should be considered a non-repairable item. Should the following procedure indicate a fault, replace the entire board.

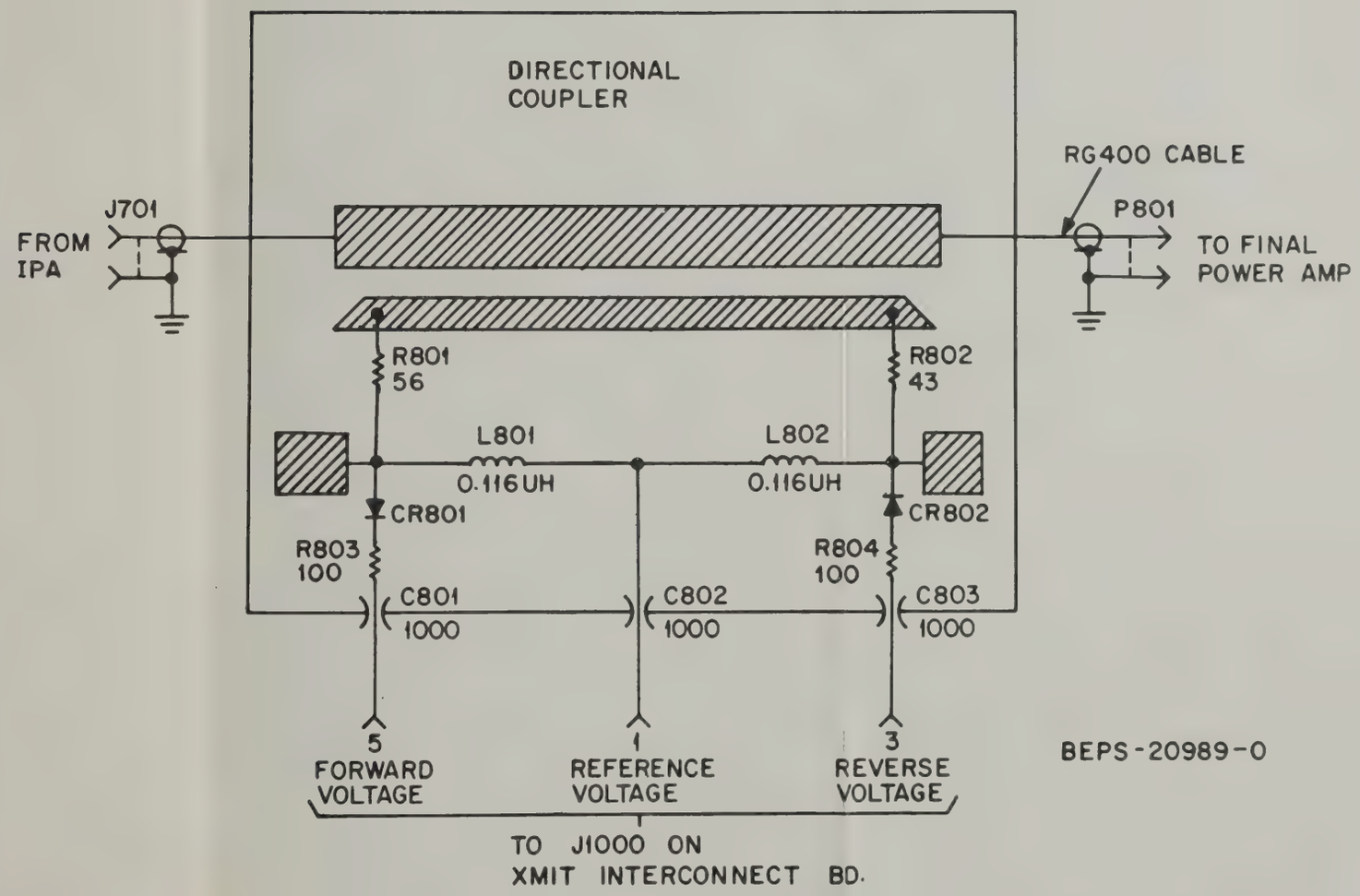
Step 1. Unplug J1000. Using an ohmmeter, place the negative lead on J1000-1 and the positive lead on J1000-5. The reading should be greater than 5 megohms. Reverse the leads. The reading should be less than 500 ohms. If readings are not within this range, replace the board.

Step 2. Using an ohmmeter, place the negative lead on J1000-1 and the positive lead on J1000-3. The reading should be less than 500 ohms. Reverse the leads. The reading should now be greater than five megohms. If readings are not within this range, replace the board.

Step 3. Connect J1000. Apply 14 watts through the coupler into a 50 ohm load. Read and record the voltage at J1000-1 (with respect to the chassis). Measure the voltage on J1000-5 (with respect to the chassis). The voltage at J1000-5 should be at least 1 volt greater than at J1000-1. If this does not occur, replace the board.

Step 4. Apply 14 watts through the directional coupler to a wattmeter, shorting stub, and 50-ohm load (in that order). Adjust the stub for no reflection. Measure the voltage at J1000-3 and J1000-1. The voltage at J1000-3 should be within ±1 volt of that at J1000-1. If this does not occur, replace the board.

Step 5. Using the shorting stub, increase the reflected power while monitoring the voltage at J1000-3. If the voltage does not decrease, replace the board.



BEPS-20989-0

PARTS LIST SHOWN
ON BACK OF THIS SHEET

68P81031E58-A
12/18/76-UP

TLF6133A Directional Coupler PL-4384-A

		CAPACITOR, fixed:
C801 thru 803	21-861219	1000 pF +100-0%; 500 V
		DIODE (SEE NOTE)
CR801, 802	48-84616A01	hot carrier
		CONNECTOR, receptacle:
J801	9-84968D01	female; single contact
J802	28-852527	male; single contact
		COIL, RF:
L801, 802	24-82542E10	0.116 uH
		RESISTOR, fixed; ±5%; 1 W
R801	6-126A19	56
R802	6-126A16	43
R803, 804	6-124A25	100; 1/4 W
MECHANICAL PARTS		
	3-138162	SCREW, tapping; 4-40 x 3/8"; 4 req'd.
	15-82045L01	COVER
	42-84284B01	RETAINER; 4 req'd.
	3-134169	SCREW, tapping; 4-40 x 1/4"; 10 req'd.
	4-83755H01	WASHER, solder; 3 req'd.

CR801

S–22899–O
31)

POWER CONTROL BOARD

MODEL TRN6716A

1. DESCRIPTION

The power control board operates as a control loop which continually monitors the output of the intermediate power amplifier (IPA) and controls that output by regulating the collector voltage applied to the IPA controlled stage.

2. CONTROL THEORY

2.1 GENERAL

Two integrated circuits are used to develop the control functions. Reflected voltage is amplified by IC602, which controls the bias to IC601. This amplified voltage and the forward voltage are compared by IC601. The output of IC601 (through Q601) regulates the base current to control stage Q902 (mounted on the unified chassis) which is used to bias the IPA driver stage.

2.2 VSWR PROTECTION CIRCUITRY

When the VSWR approaches 2.5:1, forward power from the IPA must be reduced to prevent IPA oscillation or damage. During normal operation, the voltage at J1004-3 (reflected) and J1004-2 (reference) is approximately 5 volts, producing a 5 volt output from IC602. Since the voltage at pin 5 of IC601 is normally 5.5 volts (with 14 watts of output from the IPA), CR604 is reverse biased. When excessive VSWR is present, the voltage at J1004-3 drops, causing the voltage at pin 6 of IC602 to increase. When the potential at pin 6 reaches a sufficiently high level, CR604 will conduct (reflected voltage at J1004-3 will remain constant and forward voltage at J1004-4 will decrease as VSWR increases). When CR604 becomes forward biased, the voltage at pin 5 of IC601 increases and pin 8 becomes more positive, decreasing the drive to Q902 thus lowering the control voltage to the IPA.

3. POWER CONTROL BOARD MAINTENANCE

NOTE

The power control board must be installed in a transmitter for testing to provide the necessary power, ground, and control connections. For bench testing of a board that has been removed from the radio set and replaced by a spare, another radio set is required as a test fixture for troubleshooting.

3.1 PERFORMANCE TESTS

3.1.1 Power Set Control Test

This control allows the power output of the IPA to be varied from zero (0) power out with the control fully counterclockwise to greater than the rated output. Refer to the intermediate power amplifier section of this manual.

CAUTION

For proper operation of the protection circuitry, it is imperative that the POWER SET control never be left in a position that exceeds rated power output.

Step 1. Key the transmitter.

Step 2. Adjust the POWER SET control until the rated power output is reached. Refer to Figure 1

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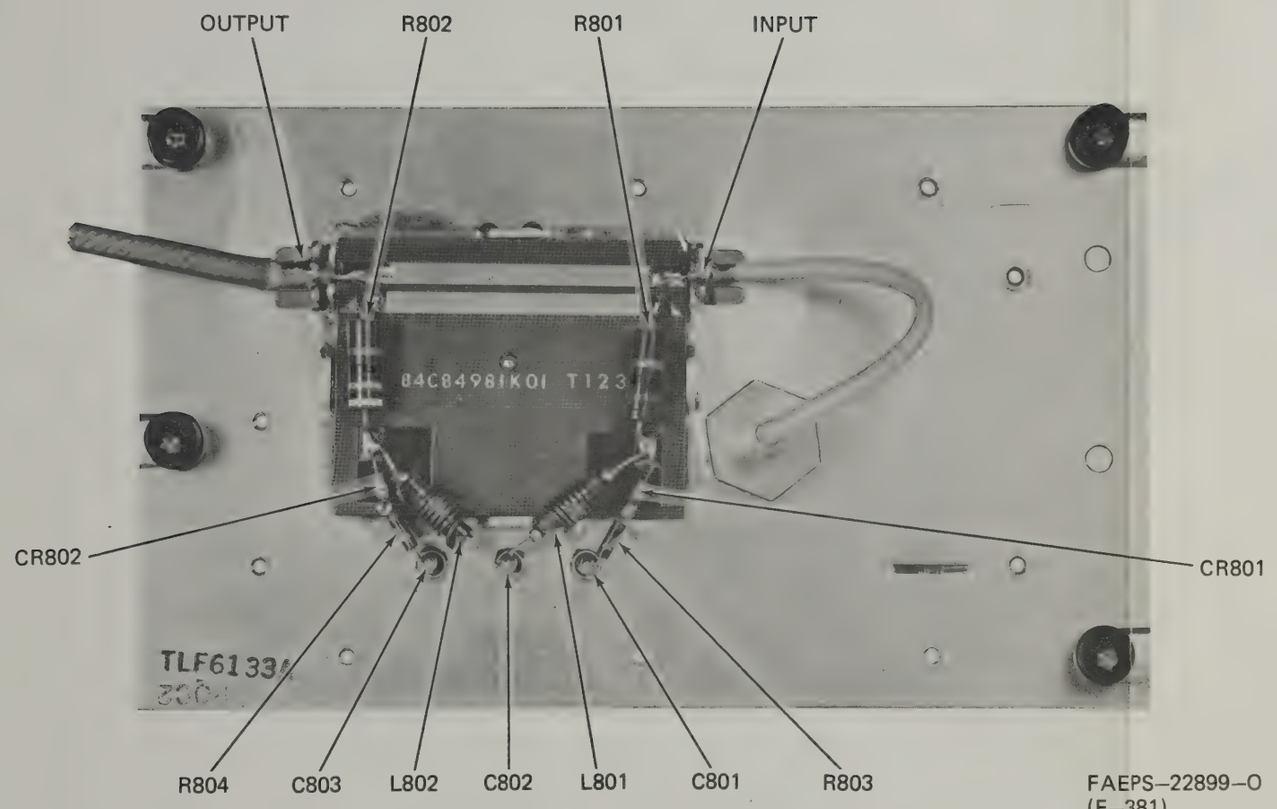

FAEPS–22899–O
(F–381)

TLF6133A Directional Coupler PL-4384-A

C801 thru 803	21-861219	CAPACITOR, fixed: 1000 pF +100-0%; 500 V
CR801, 802	48-84616A01	DIODE (SEE NOTE) hot carrier
J801	9-84968D01	CONNECTOR, receptacle: female; single contact
J802	28-852527	male; single contact
L801, 802	24-82542E10	COIL, RF: 0.116 uH
R801	6-126A19	RESISTOR, fixed; ±5%; 1 W 56
R802	6-126A16	43
R803, 804	6-124A25	100; 1/4 W
	MECHANICAL PARTS	
	3-138162	SCREW, tapping; 4-40 x 3/8"; 4 req'd.
	15-82045L01	COVER
	42-84284B01	RETAINER; 4 req'd.
	3-134169	SCREW, tapping; 4-40 x 1/4"; 10 req'd.
	4-83755H01	WASHER, solder; 3 req'd.

POWER CONTROL BOARD

MODEL TRN6716A

1. DESCRIPTION

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2. CONTROL THEORY

2.1 GENERAL

Two integrated circuits are used to develop the control functions. Reflected voltage is amplified by IC602, which controls the bias to IC601. This amplified voltage and the forward voltage are compared by IC601. The output of IC601 (through Q601) regulates the base current to control stage Q902 (mounted on the unified chassis) which is used to bias the IPA driver stage.

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When the VSWR approaches 2.5:1, forward power from the IPA must be reduced to prevent IPA oscillation or damage. During normal operation, the voltage at J1004-3 (reflected) and J1004-2 (reference) is approximately 5 volts, producing a 5 volt output from IC602. Since the voltage at pin 5 of IC601 is normally 5.5 volts (with 14 watts of output from the IPA), CR604 is reverse biased. When excessive VSWR is present, the voltage at J1004-3 drops, causing the voltage at pin 6 of IC602 to increase. When the potential at pin 6 reaches a sufficiently high level, CR604 will conduct (reflected voltage at J1004-3 will remain constant and forward voltage at J1004-4 will decrease as VSWR increases). When CR604 becomes forward biased, the voltage at pin 5 of IC601 increases and pin 8 becomes more positive, decreasing the drive to Q902 thus lowering the control voltage to the IPA.

3. POWER CONTROL BOARD MAINTENANCE

NOTE

The power control board must be installed in a transmitter for testing to provide the necessary power, ground, and control connections. For bench testing of a board that has been removed from the radio set and replaced by a spare, another radio set is required as a test fixture for troubleshooting.

3.1 PERFORMANCE TESTS

3.1.1 Power Set Control Test

This control allows the power output of the IPA to be varied from zero (0) power out with the control fully counterclockwise to greater than the rated output. Refer to the intermediate power amplifier section of this manual.

CAUTION

For proper operation of the protection circuitry, it is imperative that the POWER SET control never be left in a position that exceeds rated power output.

Step 1. Key the transmitter.

Step 2. Adjust the POWER SET control until the rated power output is reached. Refer to Figure 1

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in the intermediate power amplifier section of this manual.

Step 3. Unkey the transmitter.

3.1.2 Automatic Power Leveling Test

A separate variable voltage dc power supply must be used to perform this test.

Step 1. Disconnect the 13.6 volt lead (red wire) at the IPA. Connect a 16 volt source to the PA in its place. Set the power supply output to +13.6 volts.

Step 2. Key the transmitter.

Step 3. Vary the supply voltage from +13.6 volts to +16 volts. The IPA power output change should be between 13 watts and 15 watts.

Step 4. Unkey the transmitter and reconnect the IPA to the station's power supply.

3.1.3 Drive Limit Control

This control allows the drive power to the power amplifier from the controlled stage to be limited to a level sufficient to provide rated performance. Its purpose is to set a limit on the drive power that can be called for by the automatic power leveling circuitry. This prevents earlier IPA stages from being damaged by overdrive if later stages fail. Depending on the position of the Drive Limit control, the maximum collector voltage of the controlled stage can be limited to between 6.5 volts and 12.5 volts. The proper procedure for setting the Drive Limit Control is given in the Intermediate Power Amplifier Section of this manual.

CAUTION

For proper operation of the power leveling circuitry, the Drive Limit control must not be set for any lower output than that given in the IPA section of this manual.

3.1.3.2 In some stations, the power leveling circuitry may operate the controlled stage at a collector voltage more than 12 volts. In such stations, little or no effect will be seen from the Drive Limit control. If it is not possible to lower power output by the Drive Limit control to the level called for, set the Drive Limit control to its maximum clockwise position (maximum drive limits).

4. TROUBLESHOOTING

4.1. GENERAL

Efficient location of power control board faults requires a thorough knowledge of theory of operation. In any case, it is a good idea to review theory and the schematic diagram before performing troubleshooting procedures.

4.2 PROCEDURE

Step 1. Couple the IPA into a through-line wattmeter and a 50 ohm load to the directional coupler.

Step 2. Perform the power set control and drive limit control tests given in paragraph 3. If the power control board does not control the IPA, proceed to step 3. If there is no IPA power output, proceed to step 4.

Step 3. If the power control board does not control or level IPA power, turn R609 fully counterclockwise and R607 fully clockwise (with respect to solder side). Key the station and read meter position 1 on the station metering kit or portable test set.

(a.) If the reading is less than 5.0 uA, inspect the wiring from the directional coupler to the transmitter interconnect board. If wiring is proper, check R610 and proceed to step 3C.

(b.) Key the station. Measure and record the following directional coupler voltages:

voltage at white lead_____

voltage at yellow lead_____

If the voltage at the white lead is not between 4.5 and 6.0 volts, proceed to 3C. If the voltage at the white lead is between 4.5 and 6.0 volts and the voltage at the yellow lead is less 4.5 volts, the problem is in the directional coupler (see section 68P81031E58). If the voltage at the white lead is between 4.5 and 6.0 volts and the voltage at the yellow lead is greater than 4.5 volts, look for broken wires or plating on the transmitter interconnect board.

(c.) Measure the voltage at the anode of CR607. If the voltage is not between 4.5 and 6.0 volts, check the voltage at the emitter of Q602 (8.3 volts ±20%).

(d.) Measure the voltage at pin 1 of IC601. If the voltage is greater than 7 volts, check R604, R617, CR606, CR605, and R613.

(e.) Remove F1 on the unified chassis (7.5 amp). Key the station and measure the voltage at pin 5 of IC601 while varying R607 from minimum to maximum. If pin 5 does not vary from approximately 2.0 to 6.0 volts, check R605, R606, and R607. Reconnect F1.

(f.) Turn R609 fully counterclockwise. Key the station and, while varying R607 from maximum to minimum, measure the voltage at pin 8 of IC601. If pin 8 does not vary from 2 to 11 volts, check Q601 and, if good, replace IC601 (IC601 is usually malfunctioning if this occurs)

(g.) Key the station. Measure the voltage at the emitter of Q601 while varying R607. If the voltage does not vary from 3 to 14 volts, check Q601, Q902 (on transmitter interconnect board), and CR601.

Step 4. If there is no power output from the IPA:

(a.) Terminate the tripler and doubler into a wattmeter and a 50 ohm load. Power output should be greater than 1.3 watts. If less than 1.3 watts, check the tripler and doubler and the exciter. Reconnect the tripler and doubler to the IPA.

(b.) Turn R607 fully clockwise and R609 fully counterclockwise. Key the station and measure the voltages at the IPA input. Both the blue and red wire leads should be between 11 and 16 volts. If red lead is less than 11 volts, inspect F1 on the unified chassis, the power supply, and the plating on the transmitter interconnect board. If the blue lead is less than 11 volts, proceed to step 4C. If both red and blue leads are greater than 11 V and there is still no power output, the IPA is faulty and/or there is no input power.

(c.) Key the station and measure the voltage at the cathode of CR609. If less than 11 volts, check CR609 and the 9.6 and 13.6 volt regulator board on the low voltage power supply.

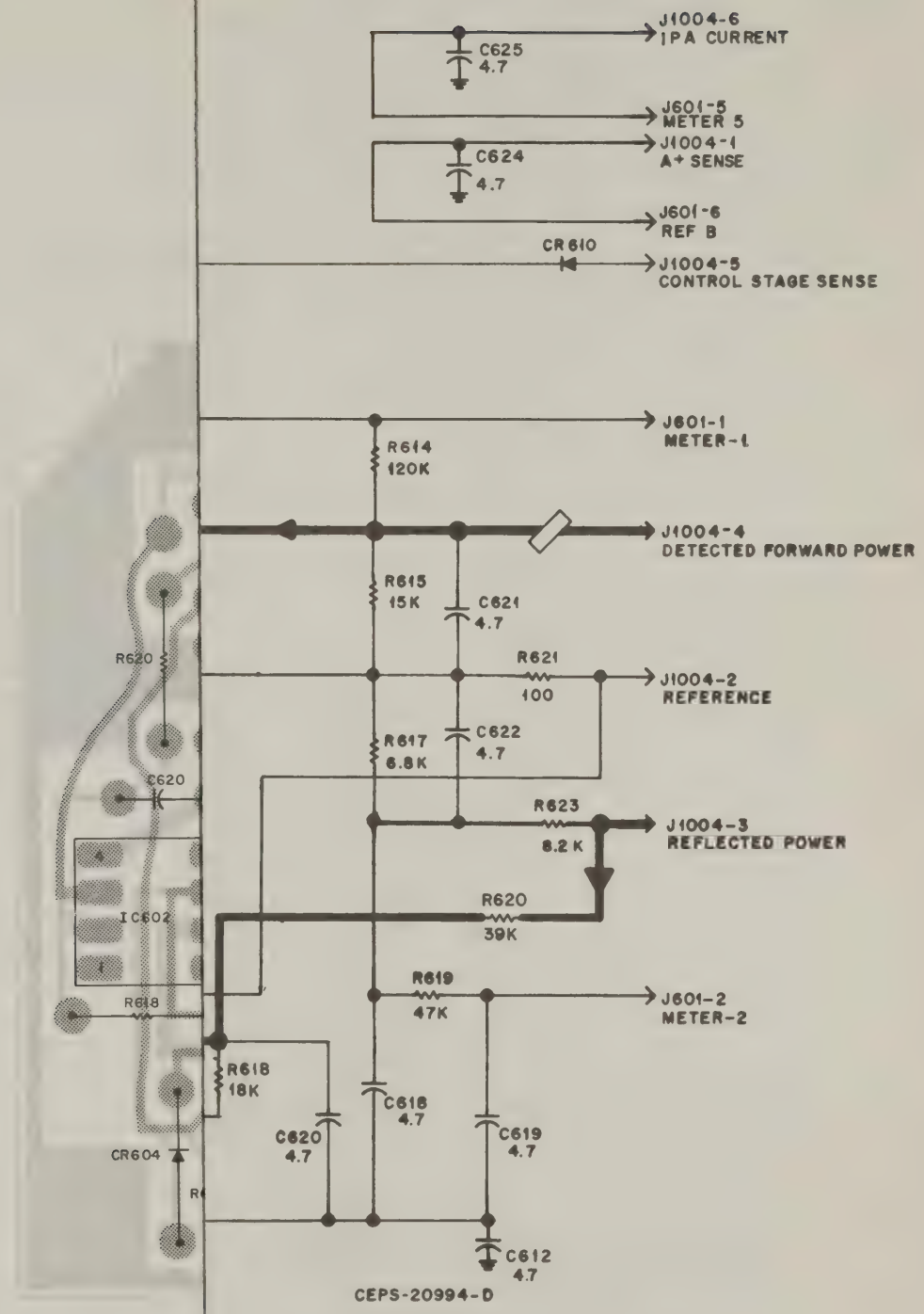
(d.) Insure that the station is unkeyed and measure the voltage at the collector of Q601. The voltage should be greater than 11 volts. Key the station. If the voltage at Q601 collector does not drop to 0.3 volts, check the station control module.

(e.) Key the station and measure the voltage at the emitter of Q602. If not 8.2 volts ±20%, check Q602 and CR602.

(f.) Short out R604 and key the station. If power from the IPA is still zero, check pin 8 of IC601. If greater than 5 volts, replace IC601. Measure the voltage at the emitter of Q601. If greater than 5 volts, check R908, CR601, R603, and Q601.

Step 5. If the power control board does not limit the drive to the IPA, set the IPA power output at 14 watts (R607). Read power control board meter position 5. This reading will vary but in all cases should be less than 38 uA. If less than 38 uA, check CR603 and R609. If greater than 38 uA, check CR610.

Step 6. If there is no power cutback under excessive VSWR conditions, remove the lead of R618 that connects with J1004-3. Connect this lead to a 0-6 volt variable power supply and terminate the IPA into a 50 ohm load. Key the station and adjust the power supply to 6.0 volts. Adjust R607 until 14 watts of output power is obtained from the IPA. If output power cannot be varied, check CR604 and R607. Vary the 0-6 volt power supply. IPA output power should increase and decrease smoothly. If power drops abruptly, check R618 and R620. If no power change is noticed, replace IC602.



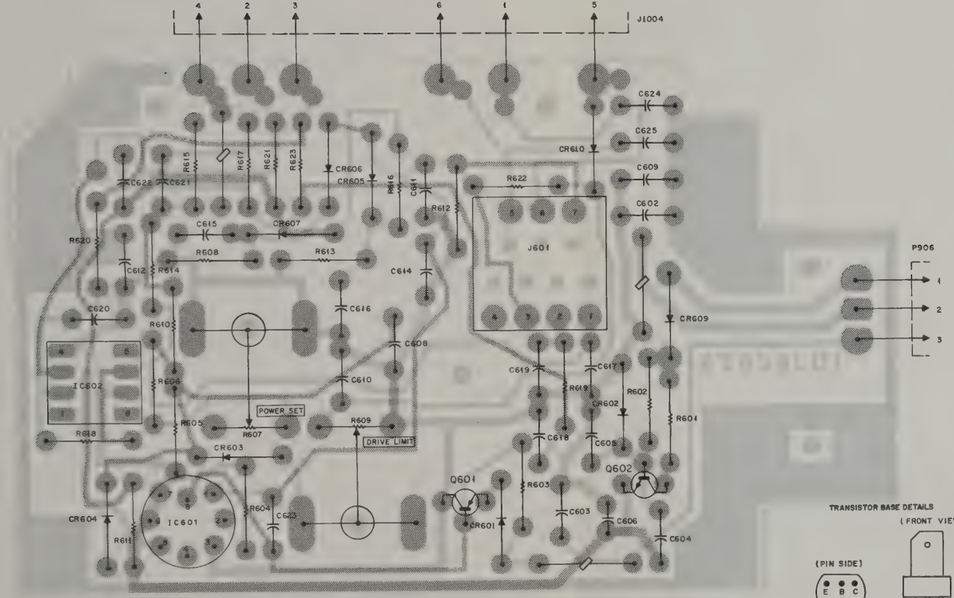
SHOWN

CATED,
COFARADS.

E BEAD.

TRN6716A-1 Power Control Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-23670-A
3/30/78-NPC

TRN6716A SUFFIX-1



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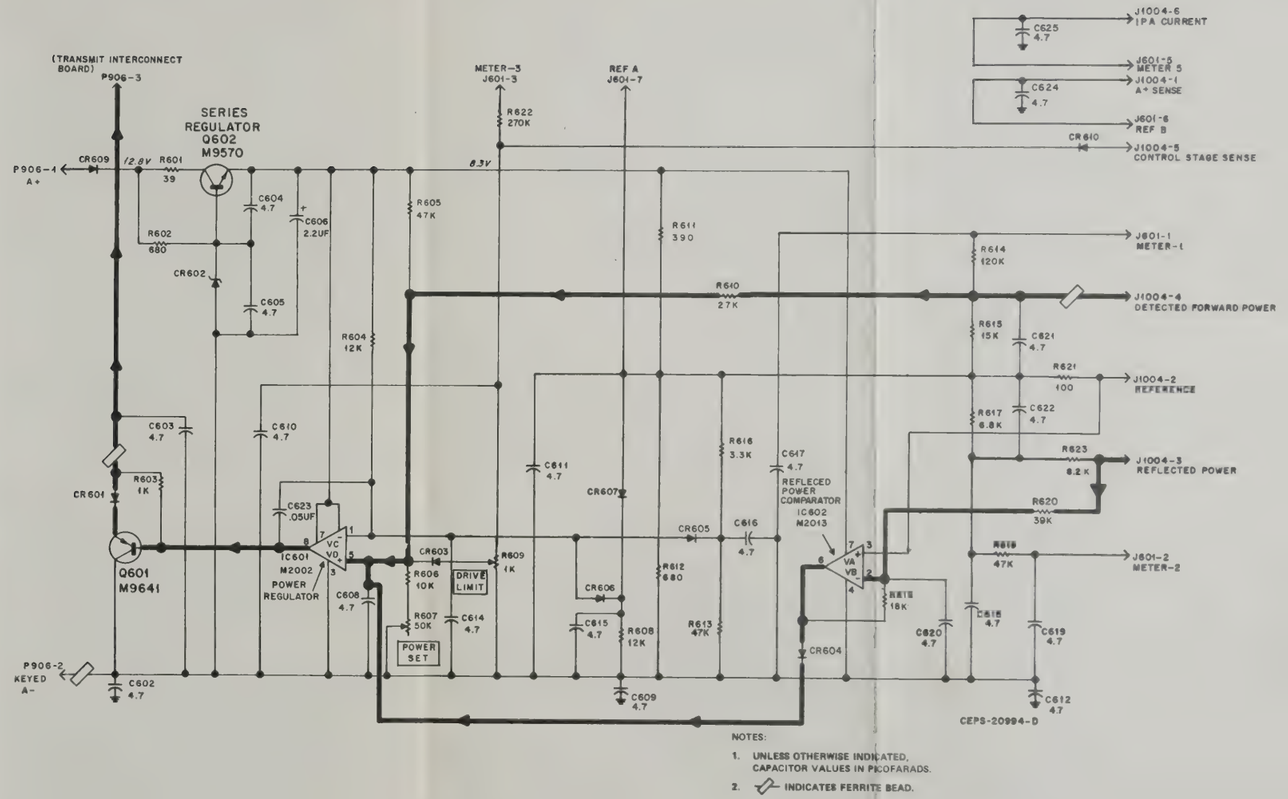
COMPONENT SIDE ⊗ BD-CEPS-23667-O
SOLDER SIDE ○ BD-CEPS-23668-O
OL-CEPS-23669-A



TRN6716A-1 Power Control Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-23670-A
3/30/78-NPC

REVISIONS

PEPS-23670-A

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TRN6716A-1	C624, 625	Added 21-82355B39, 4.7 pF	J1004 Pins 1, 6
		Printed circuit board changed From 84-849c8K01 To 84-82854L01.	
	R608	From 6-124A69, 6.8k To 6-124A75, 12k	IC602-4

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

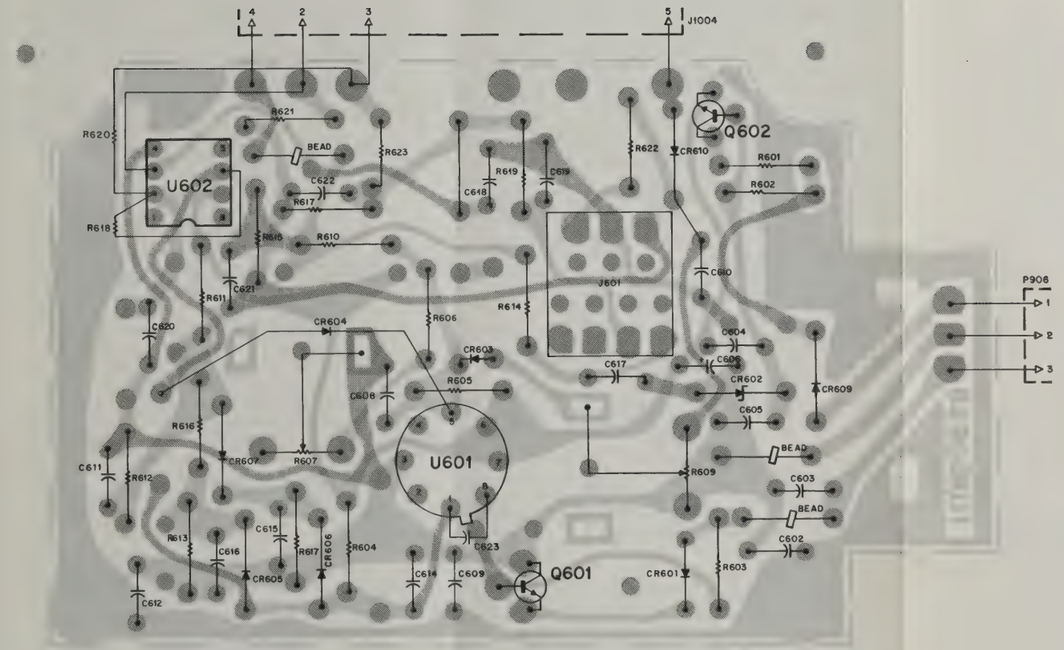
TRN6716A Power Control Board PL-4429-C

		CAPACITORS, fixed:
C602 thru C605	21-82355B39	4.7 pF; 0.25 pF; 500 V
C606	23-84538G08	2.2 uF; ±20%; 20 V
C608 thru 622	21-82355B39	4.7 pF; 0.25 pF; 500 V
C623	21-82372C07	.05 uF; +80-20%; 25 V
C624, 625	21-82355B39	4.7 pF; 0.25 pF; 500 V
		DIODE: (SEE NOTE)
CR601	48-83654H01	silicon
CR602	48-83696E04	silicon
CR603	48-4616A01	hot carrier
CR604	48-2392B03	silicon
CR605 thru 607	48-82392B18	silicon
CR609	48-82466H18	silicon
CR610	48-82392B03	silicon
		INTEGRATED CIRCUIT: (SEE NOTE)
IC601	51-84320A02	M2002
IC602	51-84320A13	M2013
		TRANSISTOR: (SEE NOTE)
Q601	48-869641	PNP; M9641
Q602	48-869570	NPN; M9570
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R601	6-124C15	39 ±10%
R602	6-124A45	680
R603	6-124C49	1k ±10%
R604	6-124A75	12k
R605	6-124C89	47k ±10%
R606	6-124C23	10k ±10%
R607	18-83083G20	variable; 50k ±30%
R608	6-124A75	12k
R609	18-83-83G14	variable; 1k ±30%
R610	6-124C83	27k ±10%
R611	6-124A39	390
R612	6-124A45	680
R613	6-124C89	47k ±10%
R614	6-124C83	27k ±10%
R615	6-124C77	15k ±10%
R616	6-124A61	3.3k
R617	6-124A69	6.8k
R618	6-124A79	18k
R619	6-124A89	47k
R620	6-124C15	39k
R621	6-124C25	100 ±10%
R622	6-124D08	270k ±10%
R623	6-124A71	8.2k
		NON-REFERENCED ITEMS
	3-134169	SCREW, tapping: 4-40 x 1/4"
	3-129506	SCREW, tapping: 4-40 x 5/16"; 4 req'd.
	5-84220B01	GROMMET
	9-84207B01	CONNECTOR, 7-contact
	42-84284B01	RETAINER, screw; 4 req'd.
	55-84300B02	HANDLE: 1.83" lg
	55-84973E01	HANDLE: 1.40" lg
	76-84069B01	FERRITE BEAD: 3 req'd
	1-80785B27	CIRCUIT BOARD ASSEMBLY includes:
	29-84028H01	TERMINAL, male; 9 req'd
	5-84500B03	EYELET, special; 4 req'd.

NOTE:

For optimum performance, replacement diodes, transistors and intergated circuits must be ordered by Motorola part numbers.

EARLIER VERSION



SHOWN FROM SOLDER SIDE

COMPONENT SIDE BD-CEPS-20991-0
SOLDER SIDE BD-CEPS-20992-0
OVERLAY OL-CEPS-20993-B

FINAL POWER AMPLIFIER

MODEL TLF1073A

BLOWER AND SHROUD

MODEL TRN6729A

TLF1073A Final PA Model Complement

MODEL	DESCRIPTION
TKN6835A	Cable Kit
TLF6063A	Amplifier Cavity
TRN6586A	Chassis and Hardware Kit
TRN6588A	Control Logic Board

1. FUNCTIONAL OPERATION

The output from the directional coupler is applied to the final power amplifier input coupling. The rf carrier is then applied to an EIMAC 3CX400U7/8961 UHF Transmitting Triode designed primarily for the 806 to 950 MHz frequency spectrum. In the supplied grounded grid, cathode driven configuration, the tube provides 125 W of final rf output power. The carrier is then coupled through a low pass, harmonic filter to the antenna.

2. ALIGNMENT PROCEDURE

CAUTION

High voltages are present when power is applied to the station.

2.1 PRELIMINARY ADJUSTMENT

Step 1. Insure that no ac power is applied to the station.

Step 2. Before attempting to align the power amplifier, insure that the exciter, IPA, and low voltage power supply adjustments have been made.

Step 3. Connect a 250 watt wattmeter between the antenna output connector and the antenna.

Step 4. Set station switches as indicated below:

Plate current control - fully counterclockwise
Output Coupling L902 - adjust so that tuning bar is horizontal to top of cabinet.

Step 5. To adjust the tuning range of the amplifier to the 850-860 MHz or 860-870 MHz bands, moveable end plates are provided on each side of the amplifier cavity. Loosen all horizontal screws and the two top and bottom vertical screws on both front and rear of the power amplifier cavity, until the end walls are hand moveable with the provided handles.

Step 6. The output tuning control will fine-tune over a 10 MHz range. The moveable end plates should be pushed toward the tube for the 806-870 MHz band and away from the tube for the 850-860 MHz band. Tighten all screws temporarily.

Step 7. Tighten down all screws on power amplifier cavity, front and rear. This step is critical.

2.2 TUNING PROCEDURE

After making preliminary adjustments, perform the following tuning procedure.

Step 1. Apply power to the station.

CAUTION

1500 V dc is present at the PA plate when power is applied to the station.

After the transmitter is enabled by the transmit inhibit circuitry (see section 68P81031E53), key the station. Adjust the input coupling shaft and

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Communications Division

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the the fine input tuning control for a minimum power control meter 2 reading. The plate current should increase and there should be an indication of power output on the 25 watt wattmeter.

Step 2. Adjust the output coupling control and then the output tuning control for maximum power output. Increase the plate current to 300 mA by adjusting the plate current control while repeaking the output coupling and then tuning controls. Retune the input controls for a minimum power control meter 2 reading.

Step 3. If the power output is less than 155 watts, oabserve the position of the white dot on the output tuning control. (See Figure 2.) If it is more than 90 degrees from the right horizontal, move the adjustable walls in towards the tube. If it is less than 30 degrees from the right horizontal, move the walls away from the tube. Be sure to retighten all power amplifier screws.

Step 4. Retune the output coupling and then output tuning controls for maximum power output; and the input controls for a minimum power control meter 2 reading. The white dot on the output tuning control should now lie roughly between 45 degrees and 60 degrees from the right horizontal.

Step 5. Decrease the plate current by adjusting the plate current control until the power output is 135 watts. Now retune the output tuning, output coupling, and input controls still maintaining 135 watts power output.

Step 6. Tighten down the output coupling and tuning controls and then the input coupling shaft and tuning controls.

3. MAINTENANCE AND TROUBLESHOOTING

3.1 PERFORMANCE CHECKS

The power amplifier should be periodically checked for proper operation. Refer to Table 1 for typical PA check points and normal readings.

3.2 TROUBLESHOOTING

If the above performance tests indicate a PA malfunction, refer to the appropriate step in the following troubleshooting procedure.

Step 1. Apply power to the station. Measure the filament voltage. If voltage is below 6.3 volts, adjust the filament voltage (see section 68P81031E53, paragraph 4). If the voltage is zero, check the filament regulator board on the low voltage power supply.

Step 2. Measure the plate voltage. If less than 1500 V dc, check the high voltage power supply (section 68P81031E52).

Step 3. Key the station and measure the output power. If power is low, perform steps 4 through 7. If power is zero, perform steps 8 through 9.

Step 4. Measure the filament voltage. If a value other than 5.0 V dc is obtained, adjust the filament voltage (see section 68P81031E53, paragraph 4).

Step 5. Measure the plate current. If low or high, adjust R900 to obtain a normal reading and

Table 1. Typical FPA Meter Readings

TEST POINT	METER READING	
	Keyed	Unkeyed
Filament Voltage	5.0 V dc	6.3 V dc
Plate Voltage	1500 V dc	1500 V dc
PA Current	< 300 mA	< 300 mA
Reflected Power	see note	see note
Power Output	60-125 watts variable	60-125 watts variable

NOTE: There is no "normal" value for reflected power. If PA is malfunctioning, refer to section 68P81031E57 for reflected power measurements.

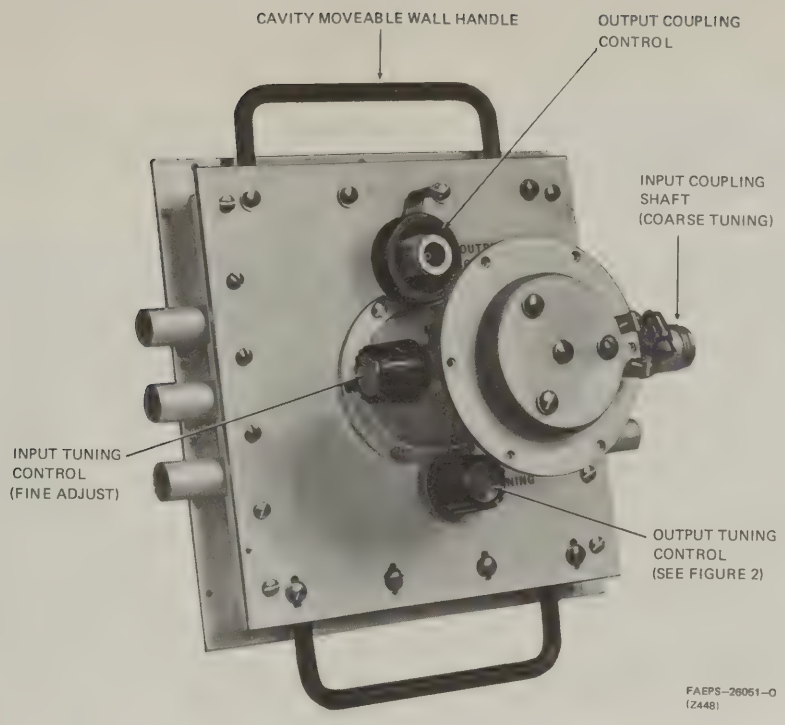

CAVITY MOVEABLE WALL HANDLE
OUTPUT COUPLING CONTROL
INPUT COUPLING SHAFT (COARSE TUNING)
INPUT TUNING CONTROL (FINE ADJUST)
OUTPUT TUNING CONTROL (SEE FIGURE 2)
FAEPS-26051-0 (Z448)

Figure 1.
Final Power Amplifier Controls

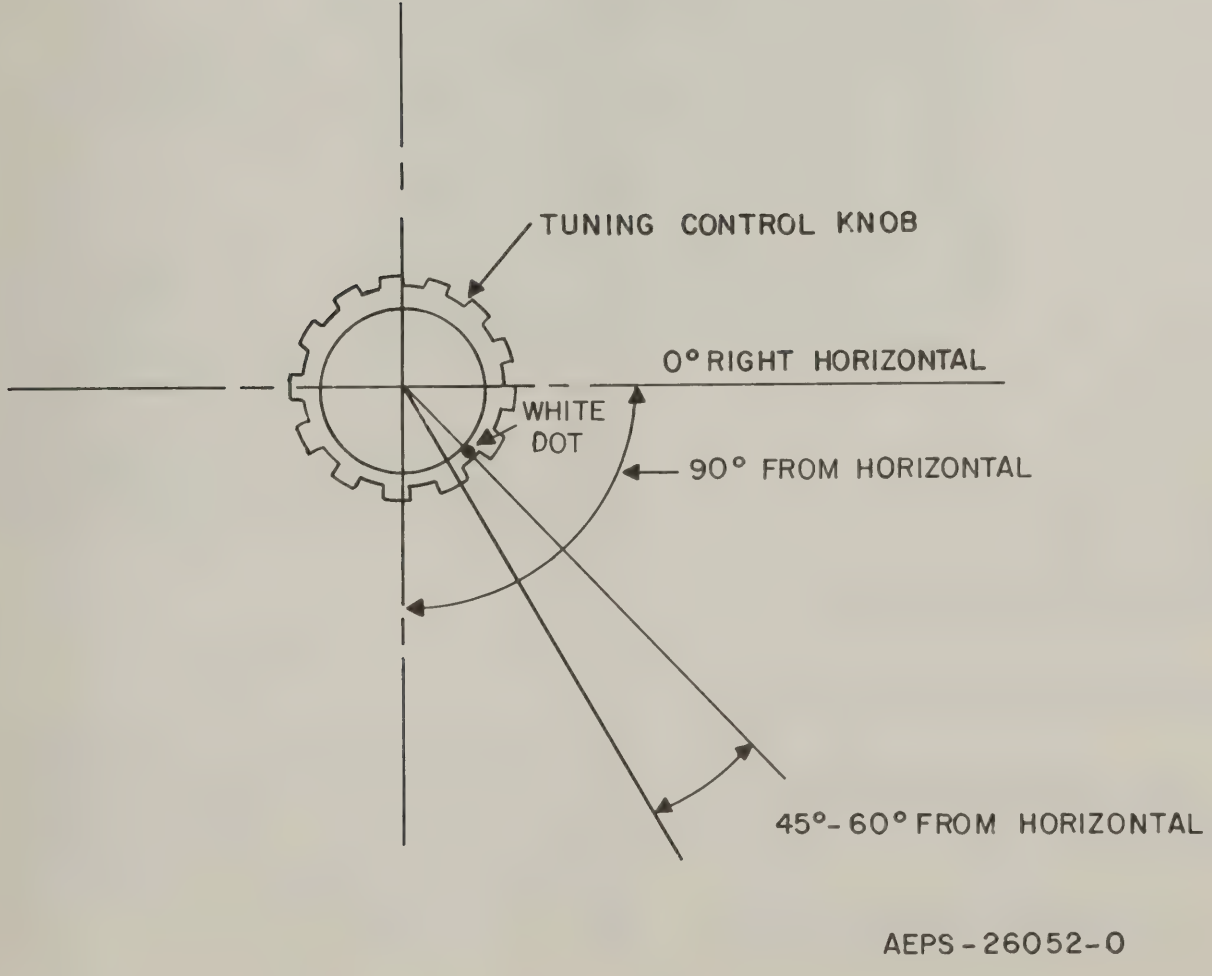


Figure 2.
Output Tuning Control Detail

retune the output coupling and tuning. If the plate current is zero, check the high voltage power supply (section 68P81031E52).

Step 6. Measure the power output. If output is low, retune the entire PA (see paragraph 3.2).

Step 7. If power output is still low, replace the PA tube (see paragraph 4.3).

Step 8. Measure the filament voltage. If other than 5.0 V dc, check the filament regulator board.

Step 9. Measure the plate current. If low, remove the cover to the TRN6588A Control Logic Board. Measure the collector voltage at Q900 (25 V dc unkeyed, 0 V dc keyed). If abnormal readings are obtained, check the biasing circuitry. If the biasing is functioning properly, replace Q900.

3.3 TUBE REPLACEMENT PROCEDURE

CAUTION

Do not twist tube during removal or insertion. Do not allow tube to "bump" finger stock during removal or insertion.

Step 1. Remove the blower cover.

Step 2. Remove the plate cap.

Step 3. Insert the tube puller (see figure 3.)

Step 4. When the tube puller is in place, pull slowly on the tube puller with the right hand while guiding the tube with the left hand. After the tube is free, check the cavity. If the finger stock or rings are bent, they must be replaced.

Step 5. Insert the new PA tube as follows: Grasp the tube firmly by the outer anode ring. Carefully find the center hold of the PA with the center filament pin and push tube slowly but firmly, without side-to-side or twisting motion, until tube is in as far as possible.

Step 6. Perform the entire tune-up procedure.

4. TRN6729A BLOWER AND SHROUD

4.1 GENERAL

The blower and shroud provides cooling for the PA tube and vents the heated air outside the cabinet. The assembly does not provide cooling for other cabinet components.

4.2 BLOWER FILTER CLEANING PROCEDURE

To insure proper operation, the filters for the PA blower must be cleaned once every six months.

Step 1. Remove filters from blower assembly.

Step 2. Clean filters either by rinsing in warm water or thoroughly vacuuming them.

Step 3. Allow filters to completely dry and replace them.

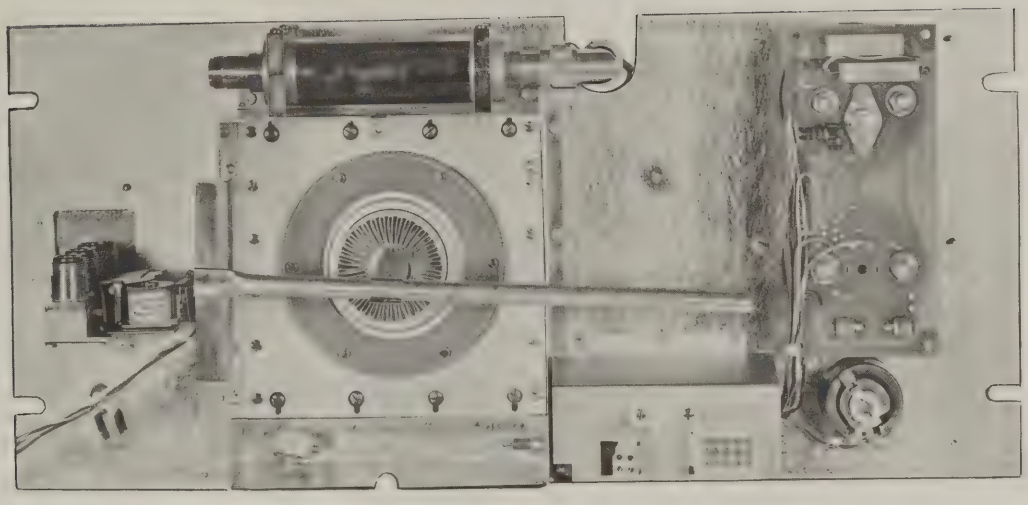
NOTE

The station can remain in operation during filter cleaning. In dusty environments, they should be cleaned more frequently (see table below).

TYPE OF ENVIRONMENT	FREQUENCY OF CLEANING FILTERS
Heavy industrial or very dusty outdoor	Each month
Outdoor (average dust)	3 months
Average Industrial (indoor)	6 months
Average Residental (indoor)	6 months

4.3 BLOWER MAINTENANCE

The blower normally does not require maintenance. The blower motor contains lifetime lubricated, sealed bearings. On the average, blower motors will provide approximately 18 months of trouble-free operation. Therefore, it is recommended that the blower motor be replaced every 18 months to ensure continued trouble-free operation.



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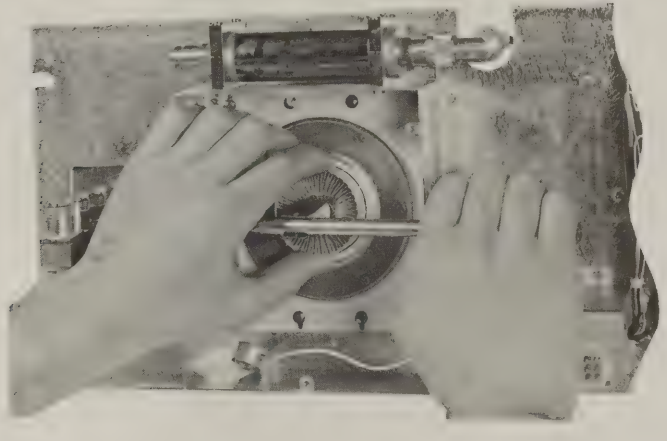

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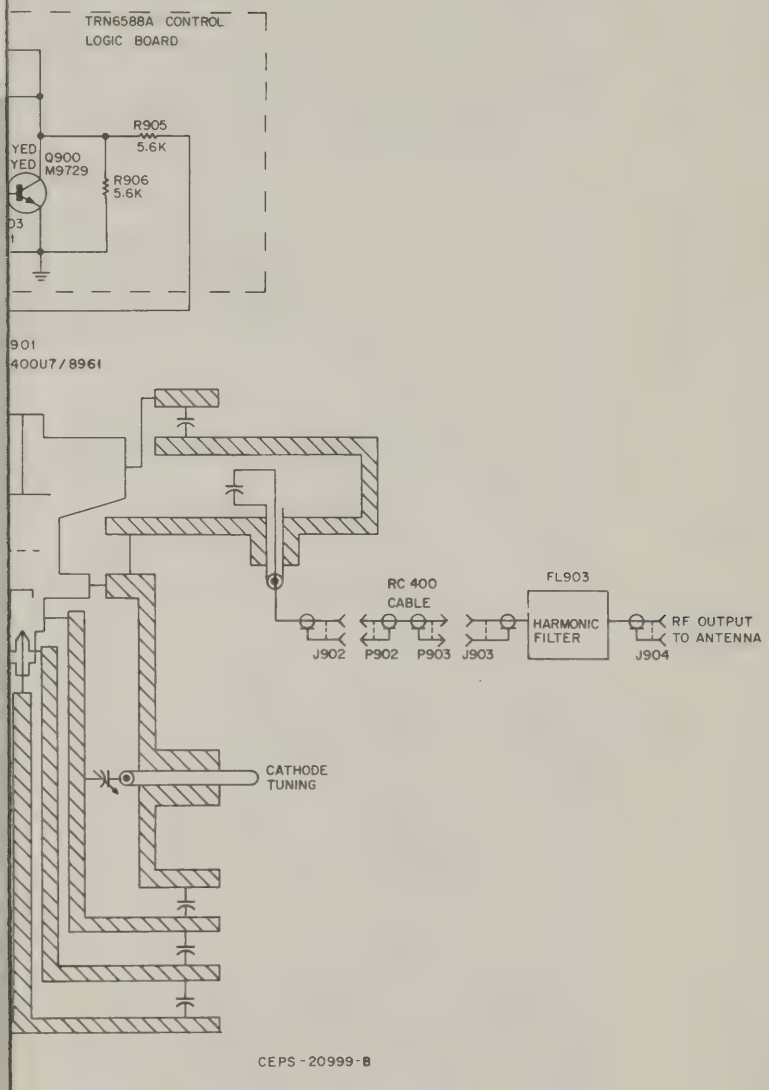
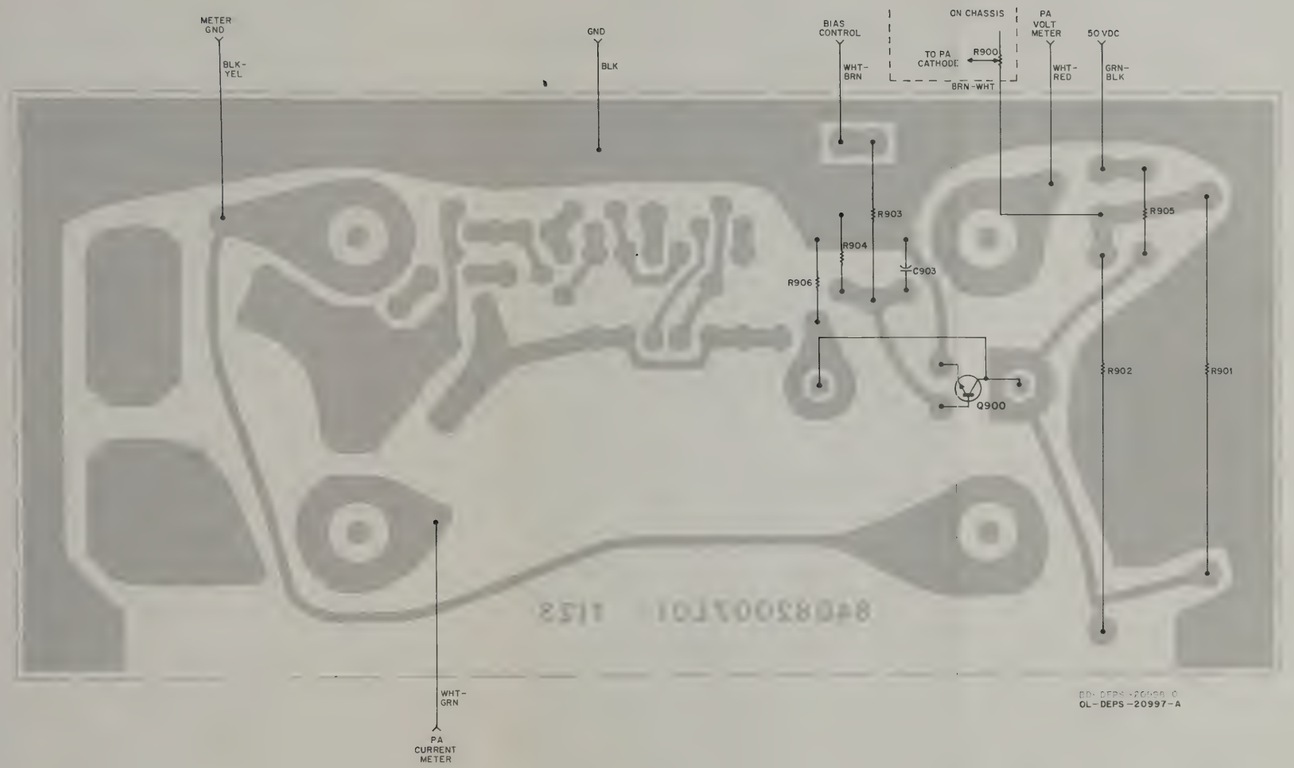
Figure 3. PA Tube Pulling Procedure



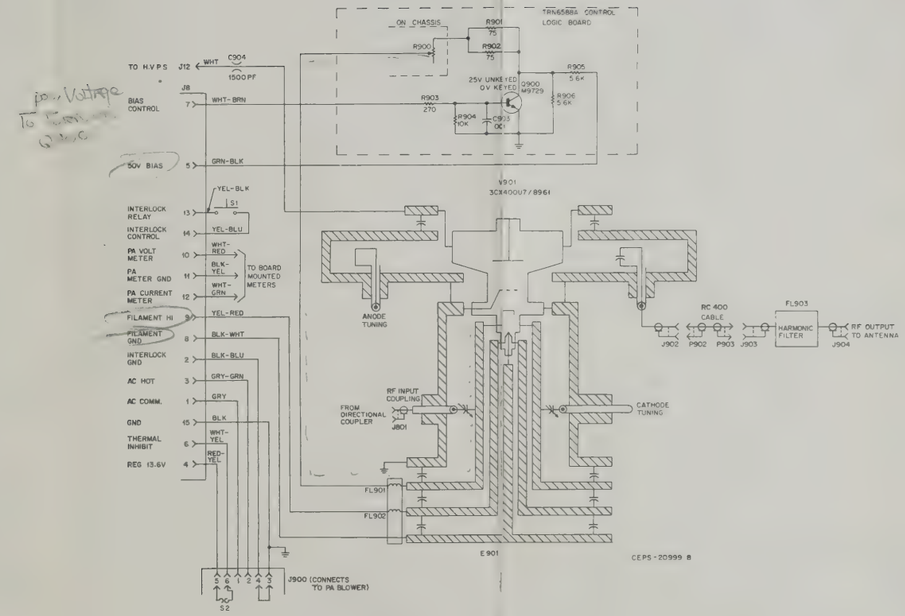
FINAL POWER AMPLIFIER

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TLF1073A Final Power Amplifier
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-21000-C
3/30/78-NPC



OL-DEPS-20997-A



MODEL TABLE

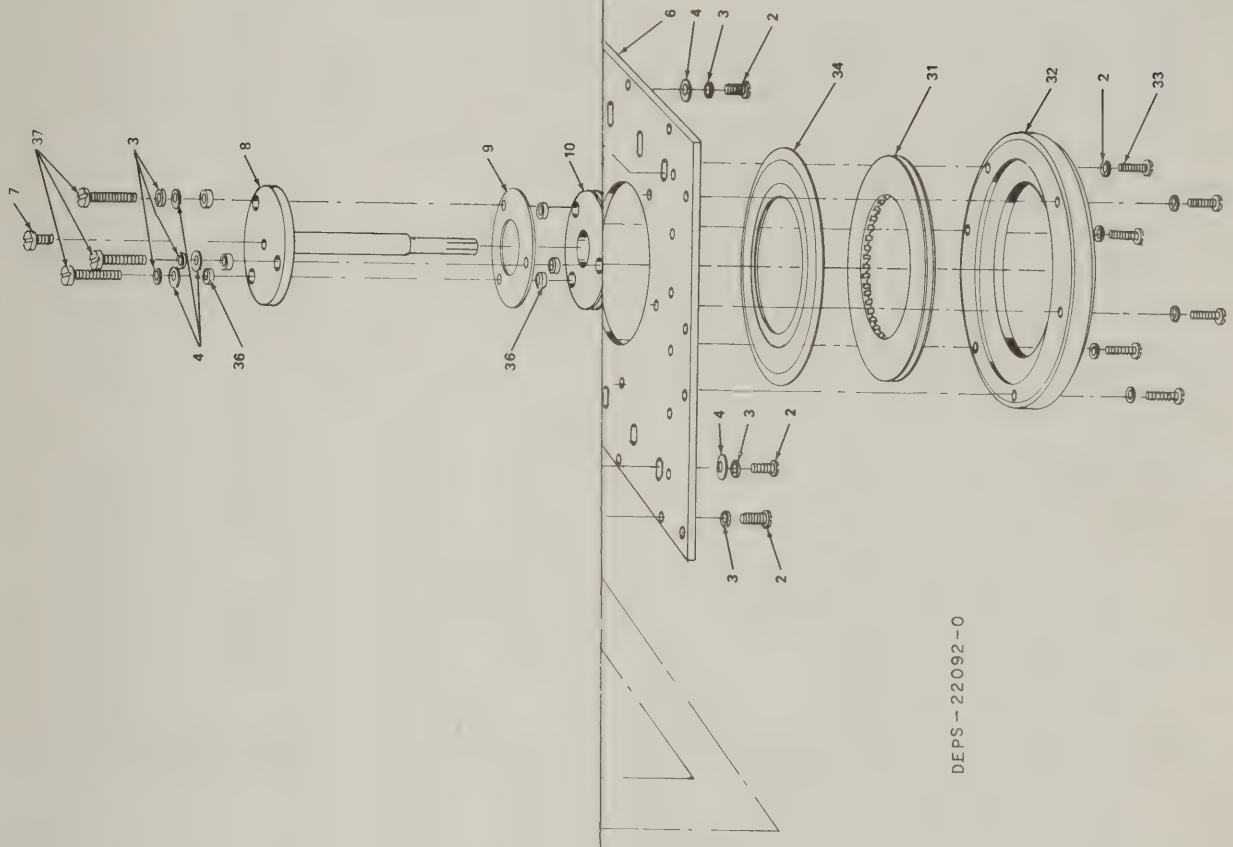
MODEL	SUB-MODEL	SUFFIX	DESCRIPTION
TLF1073A	TKN6835A		TRANSMITTER CABLE
	TLF6063A		AMPLIFIER CAVITY
	TRN6586A		CHASSIS & HARDWARE KIT
	TRN6588A		CONTROL LOGIC BOARD
TRN6729A			BLOWER KIT
TRN6672A			125 W HARDWARE KIT
TRN6572A			ANTENNA RELAY KIT

EPS-26050-O

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TLF1073A Final Power Amplifier
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-21000-C
3/30/78-NPC

N6588A



ITEM	MOTOROLA PART NO.	DESC

PARTS LIST

TLF1073A Final Power Amplifier
Mechanical Parts List

1	55-83328L01	HANDLE; 2 us
2	3-1413	SCREW, mach 44 used
3	4-8442	LOCKWASHER
4	4-114057	WASHER, flat
5	64-83328L02	GRID PANEL A
6	64-83328L03	PLATE, anode
7	3-8031	SCREW, mach 3 used
8	39-83328L04	CONTACT ASS
9	14-83328L05	INSULATOR,
10	39-83328L06	CONTACT, ou
11	14-83328L07	INSULATOR,
12	38-83328L08	CONTACT, ca
13	14-83328L09	INSULATOR,
14	3-1587	SCREW, mach
15	36-83328L10	KNOB
16	3-83328L11	SCREW, probe
17	49-83328L12	DISK, probe; 2
18	3-1287	SCREW, mach 2 used
19	47-83327L13	SHAFT, tuning
20	15-83328L14	HOUSING ASSE

TLF1073A Final Power Amplifier
Parts Location Detail
Motorola No. PEPS-22098-A
12/18/76-NPC

PARTS LIST

TKN6835A Cable Transmitter (125 Watt) PL-4378-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J8		CONNECTOR, receptacle: includes
	14-82834H03	INSULATOR, 15-circuit
	29-82335A01	CONTACT, male; 15 req'd.
J900		Includes
	15-10183A57	INSULATOR, 6-circuit
	29-82336A01	CONTACT, female; 6 req'd.
	MECHANICAL PARTS	
	29-8383C06	LUG, solderless; 2 req'd.
	42-10217A02	STRAP, cable harness

TRN6586A Chassis and Hardware Kit PL-4380-B

C904	21-83289A03	CAPACITOR, fixed: 1500 uF +100-0%; 2500 V
FL901, 902	91-87511C01	FILTER: RFI
FL901	91-84013K01	low-pass
J12	30-82904H01	CONNECTOR & CABLE ASSY, single contact
P902, 903	28-852527	CONNECTOR, plug: male; single contact
R900	18-82779L01	RESISTOR, variable: W.W. 300; 50 W
S1	40-82293F01	SWITCH, snap: spst
	MECHANICAL PARTS	
	2-131435	NUT, 4-40 x 1/4 x 3/32"; 11 req'd.
	3-1437	SCREW, machine; 4-40 x 5/8"; 2 req'd.
	3-134169	SCREW, tapping; 4-40 x 1/4"; 3 req'd.
	3-134186	SCREW, tapping; 6-32 x 5/16"; 8 req'd.
	3-135111	SCREW, tapping; 4-40 x 5/8"; 13 req'd.
	5-483208	GROMMET; 6 req'd.
	7-82040L01	FRAME, filter; 2 req'd.
	7-82075L01	BRACKET, connector mounting
	14-82311L01	INSULATOR, switch
	15-82038L01	HOUSING, filter; 2 req'd.
	15-82039L01	COVER, meter
	29-5293	LUG, soldering #4L
	29-824456	LUG, tongue
	35-82310L01	SCREEN, air; 2 req'd.
	36-82632H07	KNOB, control
	42-10217A02	STRAP, cable harness
	42-82041L01	CLIP, filter mounting; 2 req'd.
	42-82143C02	CLAMP, cable
	72-84865B06	METER
	72-84865B07	METER
	64-82306L01	PLATE, PA; mounting
	7-82074L01	MOUNTING, fan
	3-1819	SCREW, machine; 6-32 x 3/16"
	28-817985	ADAPTER, right-angle; single contact
	1-80708D74	HOUSING, PA terminal incl. ref. part FL901, 902
	1-80708D75	COVER, PA terminal
	15-82355H01	CAP, tube (V901)
	3-82227A01	SCREW, special; 6 req'd.
	3-134293	SETSCREW; 10-32 x 1/4"
	30-84173E01	CABLE, coaxial; double-shielded; 11" req'd.

TLF6063A Amplifier Cavity PL-4379-B

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
E901	1-84561K01	CAVITY: amplifier
V901	97-10794A01	TUBE, electron: 3CX400U7/8961

TRN6588A Control Logic Board PL-4381-A

C903	21-82187B20	CAPACITOR, fixed: .001 uF ±10%, 100 V
Q900	48-869729	TRANSISTOR: (SEE NOTE) NPN; Type M9729
R901, 902	17-82177B29	RESISTOR, fixed: 75 ±10%; 7 W
R903	6-126C35	270 ±10%; 1 W
R904	6-124A73	10K ±5%; 1/4 W
R905, 906	6-124C67	5.6K ±10%; 1/4 W
	MECHANICAL PARTS	
	2-7005	NUT, 6-32 x 1/4 x 3/32"; 2 req'd.
	3-7229	SCREW, machine; 6-32 x 3/8"; 2 req'd.
	4-852212	WASHER, insulator; 2 req'd.
	4-7650	WASHER, #6; 2 req'd.

TRN6729A Blower Kit PL-4385-B

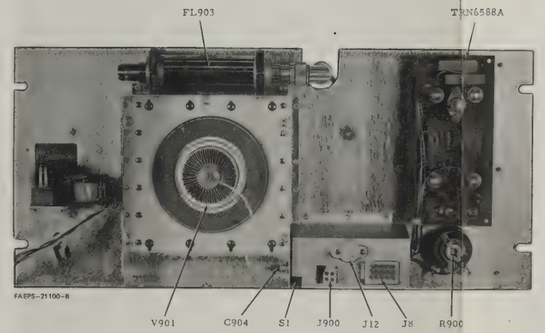
S2	40-82585L01	SWITCH: rotary, momentary
	MECHANICAL PARTS	
	3-136138	SCREW, tapping; 6-32 x 3/8"; 5 req'd.
	3-138806	SCREW, machine; 8-32 x 5/16"; 8 req'd.
	15-10183A56	INSULATOR, connector; 6-circuit
	29-82335A01	CONTACT, male; 6 req'd.
	42-83123F01	RETAINER, 5 req'd.
	59-82076L01	MOTOR, blower
	43-82548L01	SPACER

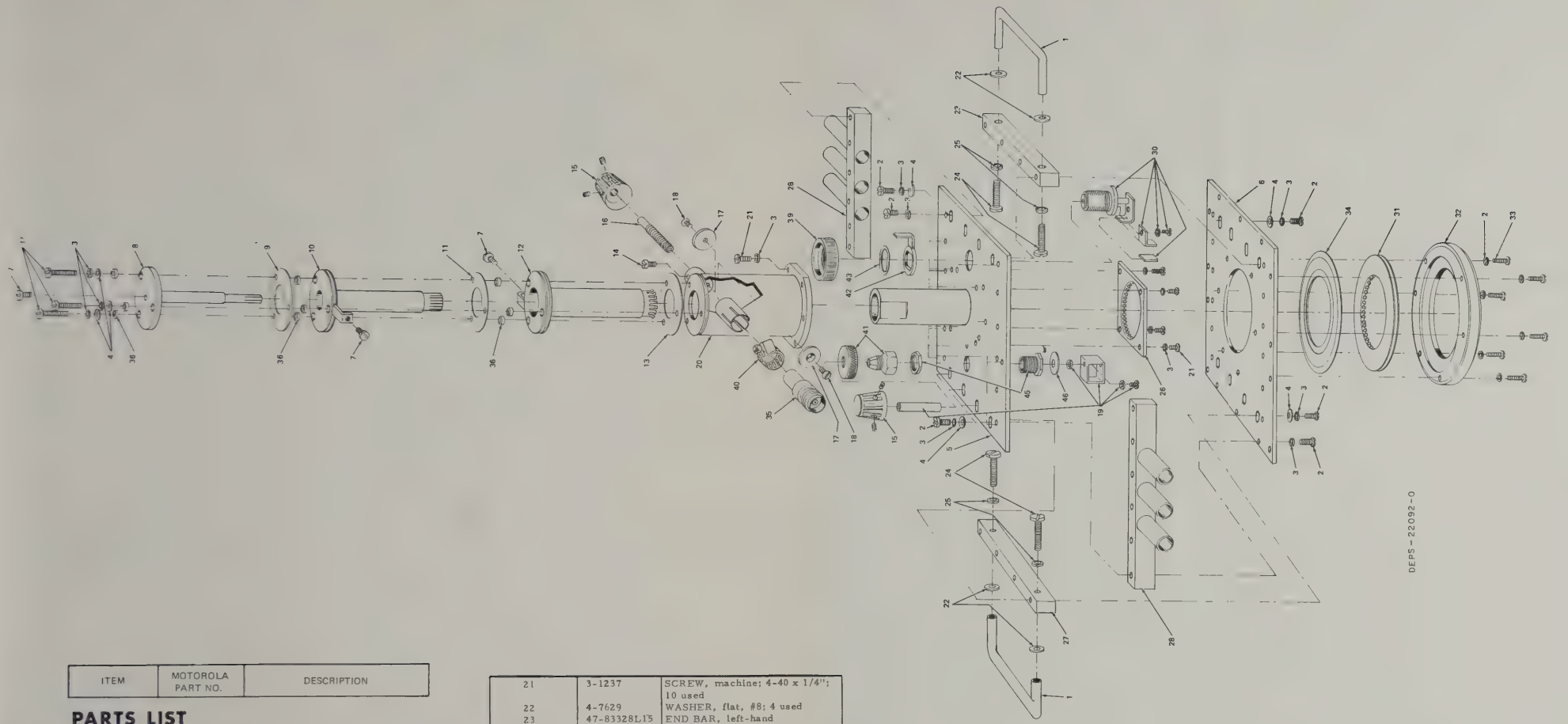
TRN6672A 125 Watt Hardware Kit PL-4430-B

	2-119913	NUT, 8/32 x 11/32 x 18" hex; 3 req'd.
	2-10101A53	NUT, spring; 2 req'd.
	2-82360B07	NUT, speed; 26 req'd.
	3-7506	SCREW, tapping; 6-20 x 1/4"; 2 req'd.
	3-8031	SCREW, machine; 6-32 x 1/4"; 2 req'd.
	3-122777	SCREW, machine; 8-32 x 1/2"; 3 req'd.
	3-134169	SCREW, tapping; 4-40 x 1/4"; 2 req'd.
	3-135038	SCREW, tapping; 14-14 x 3/4"; 26 req'd.
	3-138162	SCREW, tapping; 4 x 40 x 3/8"; 3 req'd.
	5-83885G01	RIVET
	5-84500B01	EYELET, special
	7-82317L01	BRACKET, interlock switch, 60"
	7-82875K01	BRACKET, heat sink
	11-10022A55	THERMAL JOINT COMPOUND
	14-82903K01	INSULATOR
	26-82911K01	HEAT SINK
	26-83820K01	SHIELD And INSERT, receiver
	26-84043E01	SHIELD, pc board
	26-84053E01	SHIELD, insert
	26-84278G01	SHIELD, agc
	26-84474E01	SHIELD, steel
	33-83051K01	NAME PLATE
	40-84188A01	SWITCH, interlock
	42-84284B01	RETAINER
	46-84090C01	STUD, retainer
	54-842308	LABEL, gummed
	54-850440	LABEL, FCC
	54-8304C01	LABEL, audio
	54-84857B01	LABEL, wattmeter
	55-84200B01	HANDLE, 3.52"
	55-64300B02	HANDLE, 2.12"
	66-106515	WRENCH, "Allen"
	66-84387C01	TOOL, universal tuning
	66-84690C01	TOOL, control removal
	66-82186E01	TOOL, receiver tuning
	1-80793B17	TOOL, tube pulling
	3-139564	CAPSCREW, hex: 3/8"-24 x 1/2" 2 req'd.
	4-7668	LOCKWASHER; 3/8" External tooth; 2 req'd.
	42-10217A10	STRAP, cable harness; 3 req'd.
	54-842366	LABEL, parts replacement

TRN6572A Antenna Relay Kit (Base Station Only) PL-4434-O

		Field servicing of this unit is not recommended. Order entire unit for replacement.



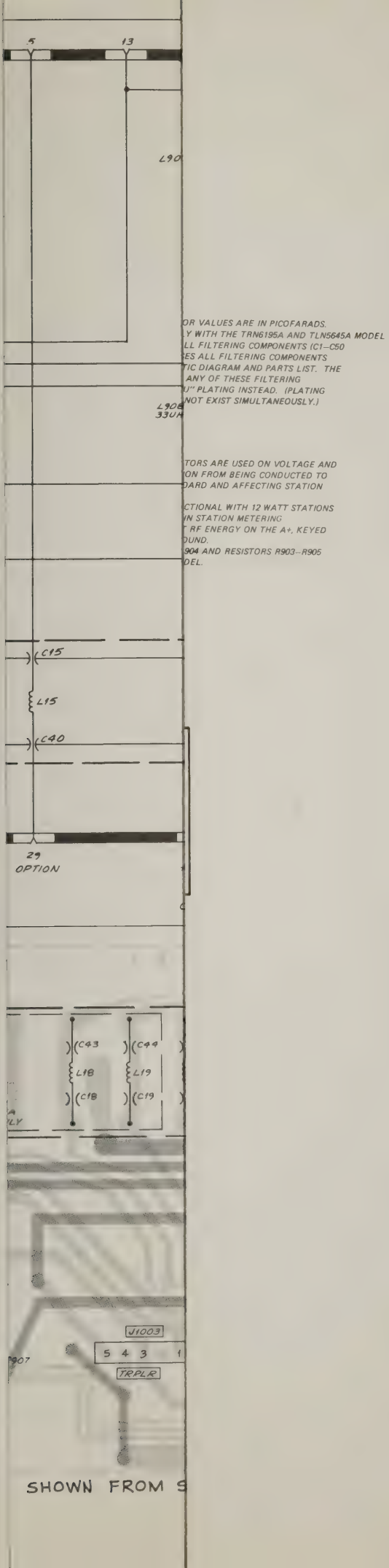


ITEM	MOTOROLA PART NO.	DESCRIPTION

PARTS LIST

TLF1073A Final Power Amplifier
Mechanical Parts List PL-5041-O

1	55-83328L01	HANDLE; 2 used
2	3-1413	SCREW, machine; 4-40 x 5/8"; 44 used
3	4-8442	LOCKWASHER, #4 split; 55 used
4	4-114057	WASHER, flat #4; 19 used
5	64-83328L02	GRID PANEL ASSEMBLY
6	64-83328L03	PLATE, anode
7	3-8031	SCREW, machine; 6-32 x 1/4"; 3 used
8	39-83328L04	CONTACT ASSEMBLY, heater
9	14-83328L05	INSULATOR, inner heater
10	39-83328L06	CONTACT, outer heater
11	14-83328L07	INSULATOR, outer heater
12	38-83328L08	CONTACT, cathode
13	14-83328L09	INSULATOR, cathode
14	3-1587	SCREW, machine, 6-32 x 5/16"
15	36-83328L10	KNOB
16	3-83328L11	SCREW, probe
17	49-83328L12	DISK, probe; 2 used
18	3-1287	SCREW, machine; 6-32 x 1/4"; 2 used
19	47-83327L13	SHAFT, tuning
20	15-83328L14	HOUSING ASSEMBLY
21	3-1237	SCREW, machine; 4-40 x 1/4"; 10 used
22	4-7629	WASHER, flat, #8; 4 used
23	47-83328L15	END BAR, left-hand
24	3-1979	SCREW, machine, 8-32 x 7/8"; 4 used
25	4-2628	LOCKWASHER, split; 4 used
26	1-83328L16	GRID COLLET ASSEMBLY
27	47-83328L17	END BAR, right-hand
28	1-83328L18	SIDE BAR ASSEMBLY; 2 used
29	33-83328L19	NAMEPLATE, logo
30	1-83328L20	CONNECTOR ASSEMBLY (output
31	1-83328L21	ANODE COLLET ASSEMBLY
32	42-83328L22	CLAMP, ring anode
33	3-1534	SCREW, machine; 4-40 x 7/16"; 6 used
34	14-83328L23	INSULATOR, anode
35	58-83328L24	SLIDING PROBE
36	14-83328L25	INSULATOR, screen; 9 used
37	3-400309	SCREW, machine, 4-40 x 5/8"; 3 used
38	54-83328L26	LABEL, coupling
39	36-83328L27	KNOB, locking
40	42-83328L28	CLAMP, hose; 5/8"
41	55-83328L29	LOCK, shift with knob
42	58-83328L30	ADAPTER, tuning
43	4-83328L31	WASHER, wave
44	54-83328L32	LABEL, tuning
45	43-83328L33	BEARING, panel
46	4-83328L34	WASHER, mylar



TRANSMITTER INTERCONNECT BOARD

MODEL TLN5645A (RPTR)

MODEL TLN5647A (BASE)

MODEL TRN6195A (FULL FILTERING OPTION)

FUNCTIONS -

--Interconnects most transmitter circuit boards to each other (except PA).

--Routes control functions from the unified chassis interconnect board to the transmitter.

--Repeater version includes unique transmitter filtering components.

--Includes partial control stage circuitry used to govern PA power output.

--Includes current limiter stage (base stations only) which is electrically functional with antenna network.

68P81031E71-O
5/23/76-NWP

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

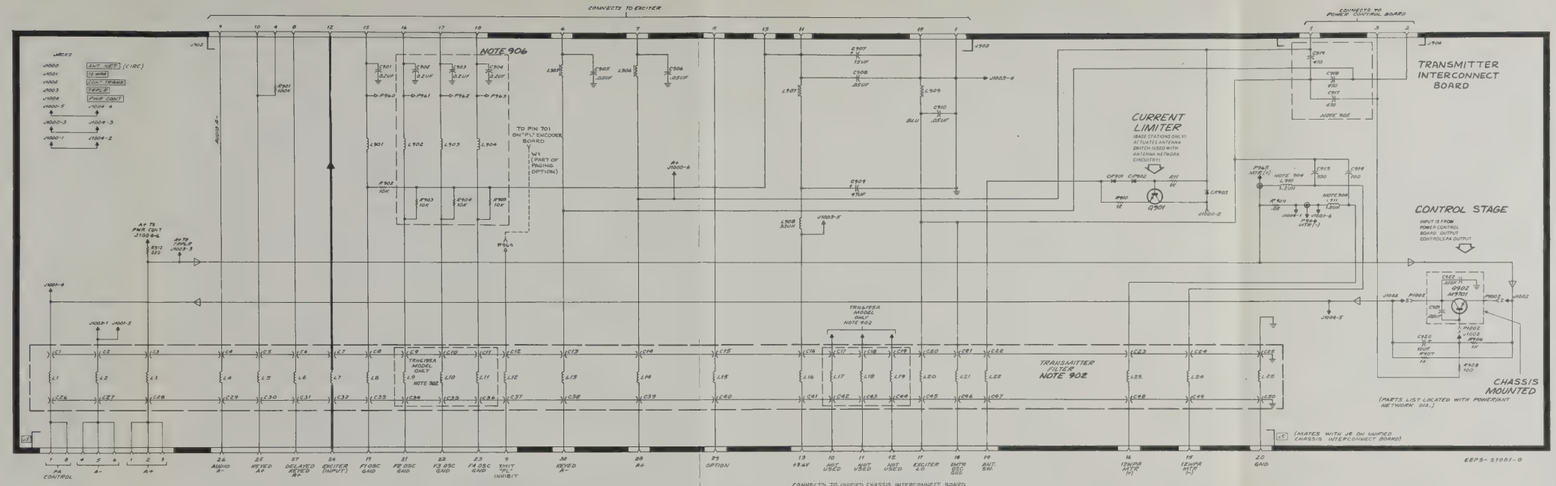
PARTS LIST

TRANSMITTER INTERCONNECT BOARD
TRN6195A (full filtering option)
TLN5645A (repeater standard)
TLN5647A (base standard)

PL-3407-A

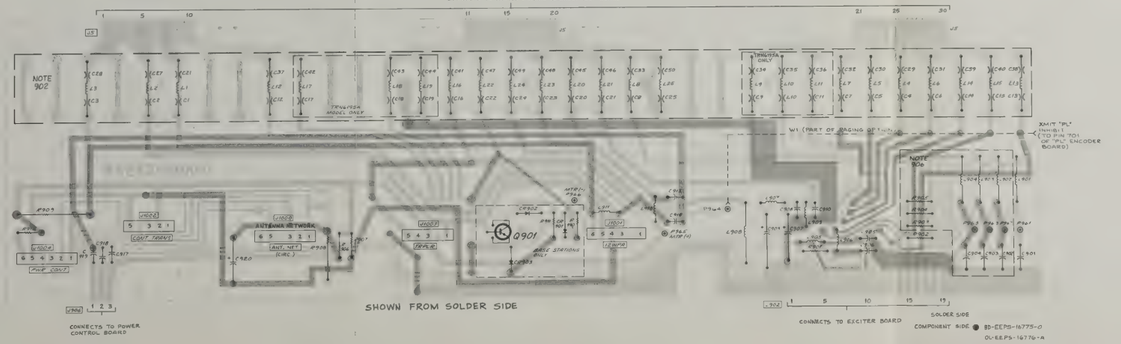
C1 thru C50	21-86l219	CAPACITOR, fixed: 1000 pF +100-0%, 500 V (NOTE 2, 3)
C901, 902, 903, 904	21-82372C02	0.2 uF +80-20%, 25 V (NOTE 2)
C905, 906, 907, 909, 910	21-82372C04	0.05 uF +80-20%, 25 V
C907	23-83214C02	15 pF ±20%, 20 V
C909	23-82783131	47 pF ±20%, 20 V
C911, 912		NOT USED
C913, 914	21-82204B06	100 pF ±10%, N1500
C915, 916		NOT USED
C917, 918, 919, C920	21-82187B07 23-83214C20	470 pF ±10%, 500 V 10 pF ±20%, 20 V
		DIODE: SEE NOTE1
CR901, 902	48-82192B12	silicon
CR903	48-82466H02	silicon
		CONNECTOR, receptacle:
J1000, 1004	28-83441F01	male, 9 pin, white
J1001	28-83441F06	male, 6 pin, red
J1002	28-83441F04	male, 5 pin, red
J1003	28-83441F05	male, 5 pin, white
		inductors
L1, 2, 3	24-84346A01	choke 0.09 uH (NOTE 3)
L4, 5, 6, 13, 14 to 20, 22, 23, L7, 8, 9, 10, 11, 12, 15, 17, 18, 19, 21, 23, 24, 905, 906, 907, 909	24-83973B01	1 1/2 turns (NOTE 2, 3)
L901, 902 903, 904	24-84900A61	choke 0.62 uH (NOTE 2)
L908	24-8543114	choke 33 uH
L910, 911	24-82723H01	choke 1.2 uH
		TRANSISTOR: (SEE NOTE 1)
Q901	48-8469640	type M9640
		RESISTOR, fixed: ±10%, 1/4 W, unless otherwise stated
R901	6-124C97	100Ω
R902, 903, 904, 905	6-124C73	10k (NOTE 2)
R906, 907, 911	6-124C49	1k
R908	17-82291B21	100 ±5%, 3 W
R909	17-82620B03	0.02 ±5%, 3 W
R910	6-124A03	12 ±5%
	NON-REFERENCED ITEMS	
	3-134169	SCREW, tapping: 4-40 x 1/4" "Phillips", hex head
	3-139495	SCREW, tapping: 4-40 x 5/16" "Phillips", hex head
	5-84220B01	GROMMET
	14-83375K01	INSULATOR
	42-83629C01	FASTENER, driver
	1-80775B71	FILTER BRACKET ASSY.
	1-80775B75	FILTER BRACKET COVER

NOTE:
1. Replacement diodes and transistors must be ordered by Motorola part number only for optimum performance.
2. The following items are not used with Model TLN5645A: Capacitors C9, 10, 11, 17, 18, 19, 34, 35, 36, 42, 43, 44, 902, 903, and 904; Coils L9, 10, 11, 23, 24, 25, 902, 903, and 904. Resistors R903, 904, and 905.
3. The following items are not used with Model TLN5647: Capacitors C1-50; Coils L1-25.


CONNECTS TO EXCITER
NOTE 906
TRANSMITTER INTERCONNECT BOARD
CONNECTS TO POWER CONTROL BOARD
CURRENT LIMITER
CONTROL STAGE
CHASSIS MOUNTED
TRANSMITTER FILTER NOTE 902
TRANSMITTER MODEL ONLY NOTE 902
TO PIN 701 ON "PL" ENCODER BOARD
W1 (PART OF PAGING OPTION)
(PARTS LIST LOCATED WITH POWERCAT NETWORK DIA.)
(GATES WITH 'JE' ON UNIFIED CHASSIS INTERCONNECT BOARD)
EEPS-21001-O

NOTES:
801 UNLESS OTHERWISE SPECIFIED CAPACITOR VALUES ARE IN PICOFARADS.
802 FILTERING COMPONENTS ARE USED ONLY WITH THE TRN6195A AND TLN5645A MODEL MODELS. THE TRN6195A MODEL USES ALL FILTERING COMPONENTS (C1 THRU C50 AND L1 THRU L25). THE TLN5645A MODEL USES ALL FILTERING COMPONENTS EXCEPT AS INDICATED ON THE SCHEMATIC. THE TLN5647A AND TLN5647A-1 MODELS (BASE MODEL) DOES NOT USE ANY OF THE FILTERING COMPONENTS BUT INCORPORATES THREE PLATING STRAP PLASTIC RUNS AND FILTERING COMPONENTS DO NOT EXIST (MAKE FARADAY).
803 FILTERING CHOKES AND BYPASS CAPACITORS ARE USED ON VOLTAGE AND GROUND RUNS TO PREVENT RF RADIATION FROM BEING CONDUCTED THE UNIFIED CHASSIS INTERCONNECT BOARD AND AFFECTING STAGE PERFORMANCE.
804 FILTERING CHOKES L910 AND L911 (FUNCTIONAL WITH 12 WATT STATIONS ONLY) PROVIDE FILTERING FOR BUILT-IN STATION METERING.
805 CAPACITORS C917, C918 AND C919 SHUNT RF ENERGY ON THE A+ KEYED A+ AND POWER CONTROL LEADS TO GND.
806 CAPACITORS C900 - C904 CHOKES L900 - L904 AND RESISTORS R903 - R905 NOT USED ON TLN5645A (REPEATER) MODEL.

LEGEND
- ELECTRICAL OPERATION DATA
- PRIMARY SIGNAL FLOW
- SECONDARY SIGNAL FLOW



TRANSMITTER INTERCONNECT BOARD

MODEL TLN5645A (RPTR)
MODEL TLN5647A (BASE)
MODEL TRN6195A (FULL FILTERING OPTION)

FUNCTIONS

--Interconnects most transmitter circuit boards to each other (except PA).

--Routes control functions from the unified chassis interconnect board to the transmitter.

--Repeater version includes unique transmitter filtering components.

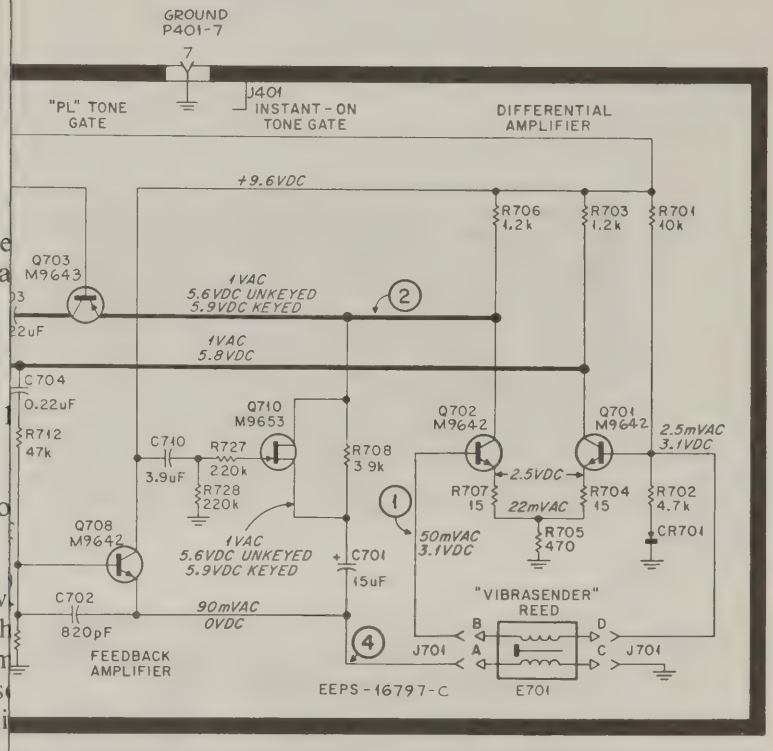
--Includes partial control stage circuitry used to govern PA power output.

--Includes current limiter stage (base stations only) which is electrically functional with antenna network.

68P81031E71-O
5/23/76-NWP

NE "PRIVATE-LINE" ENCODER

EL TLN5731A



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"PL" ENCODER

701. ALL AC VOLTAGE MEASUREMENTS ARE RMS VALUES. ALL AC VOLTAGES ARE SINUSOIDAL EXCEPT Q708 EMITTER. METER READING DEPENDENT UPON METER RESPONSE TO NON-SINUSOIDAL WAVE.

702. DC VOLTAGE MEASUREMENTS IN Q705, Q706 AND Q707 STAGES TAKEN WITH RESPECT TO A-. VOLTAGES FOR ALL OTHER STAGES TAKEN WITH RESPECT TO CHASSIS GROUND. ALL DC VOLTAGES MAY BE MEASURED WITH 20,000 OHM-PER-VOLTMETER OR HIGH IMPEDANCE DC VOLTMETER (11 MEGOHM) EXCEPT BASE OF Q704 WHICH CAN ONLY BE MEASURED WITH A HIGH IMPEDANCE METER.

703. UNLESS OTHERWISE STATED: CAPACITOR VALUES ARE IN PICOFARADS. RESISTOR VALUES ARE IN OHMS.

704. PIN 701 IS USED ONLY FOR CERTAIN OPTIONAL EQUIPMENT.

705. PINS J401–6 AND –7 ON THE PL ENCODER MATE WITH PINS P401–11 AND –12 ON THE EXCITER.

NEPS–7051–B

TONE "PRIVATE-LINE" ENCODER

MODEL TLN5731A

TECHNICAL CHARACTERISTICS

"PL" TONE FREQUENCY	Selected from 67-210 Hz range
FREQUENCY DETERMINING DEVICE	"Vibrasender" Resonant Reed
STABILITY	±0.15%
LEVEL (nominal)	350 mV rms
OUTPUT IMPEDANCE	4.7k ohms
POWER REQUIREMENTS	+9.6 V dc @15 mA

1. DESCRIPTION

The "Private-Line" (PL) encoder generates a low-frequency audio tone for continuous modulation of the transmitted rf signal in "Private-Line" operation.

2. FUNCTIONAL OPERATION

2.1 GENERAL

The encoder may be divided into three major sections.

Tone Oscillator -- The tone oscillator generates two equal-amplitude tone signals 180° out-of-phase whenever power is applied to the radio. A feedback amplifier provides negative feedback to limit the level of oscillation. The "Vibrasender" resonant reed determines the frequency of operation.

Reverse Burst Timing Generator -- The reverse burst timing generator provides a transmitter turn-off delay of approximately 150 milliseconds after the transmitter is unkeyed. During this period, a shifted phase tone (reverse burst) is developed in the tone output circuit which dampens the oscillations of the "Vibrasponder" resonant reed in listening receivers to eliminate the "squelch tail" noise burst at the end of the message.

Tone Output Circuit -- The tone output circuit provides a fixed level tone output to the modulator of the transmitter and shifts the phase of the tone during the reverse burst period to rapidly dampen the "Vibrasponder" resonant reeds in listening receivers.

2.2 TONE OSCILLATOR

The tone oscillator operates continuously while the station is "on". The outputs of the differential amplifier, formed by Q701 and Q702, are identical but 180° out of phase. The amplitudes of these collector signals are independent of frequency. A positive feedback signal is coupled through C701 and R708 which biases Q710 on through R727. To quickly bring the tone output up to full output, Q710 acts as a shunt around R708, which increases the positive feedback. After approximately 1.5 seconds (voltage across C710 reaches 9.0 volts) Q710 turns off and has no further effect on circuit operation. The output of Q701 is applied to feedback amplifier Q708 through C704 and R712. When the signal level exceeds a fixed amount, Q708 is biased into operation. It provides a negative feedback signal which keeps the oscillator out of limiting, thus provided a sinusoidal wave output. The "Vibrasender" resonant reed is the frequency determining device of the oscillator. It acts as a very high Q, narrow bandpass transformer, coupling only its resonant frequency and blocking all others. At its resonant frequency, the reed vibrates to couple energy from the primary to the secondary winding.

2.3 REVERSE BURST TIMING CIRCUIT

In the unkeyed transmitter condition, delay generator, Q706, is forward biased through CR703 and R719 to A- placing A+ across R721. This voltage is coupled to the base of the delayed turn-off switch (Q707) by R722, and Q707 is biased "off".

When the PTT button is closed, keyed filtered A+ is applied to R716 and turns on the keying switch, Q705. With Q705 acting as a short circuit:

--Q707 is biased "on" through R723, CR702 and Q705 to A-.

--Keyed, filter A+ is applied through Q707 to turn on the transmitter.

--C708 charges from the filtered A+ line through Q706 base-emitter junction, CR730 and R718.

--The PL switch gate, Q709, is turned on by bias current through R726 and Q705. This action turns off PL tone gate, Q703.

Note that Q706 has not changed states and is still turned on by bias current through R719.

When the PTT button is released, the keyed, filter A+ bias is removed from Q705 and it turns off. The transmitter continues to receive A+ from Q707 during the following sequence of events; with Q705 turned off:

--The PL switch gate, Q709, is turned off, activating the PL tone gate, Q703, which passes the reverse burst tone signal.

--C708 discharges through R718, R719, R721, R722 and R723, back biasing CR703 and turning off Q706.

--With Q706 off, Q707 remains on by receiving base bias through R722 and R721.

--After approximately 150 milliseconds, the voltage across C708 decreases to the point where Q706 turns on again and applies A+ across R721.

--The A+ across R721 turns off Q707 which removes the delayed keyed filter A+ from the transmitter.

2.4 TONE OUTPUT CIRCUIT

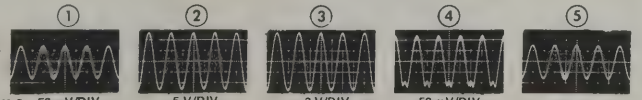
When the transmitter is keyed, PL gate switch Q709 is turned on. Q709, in turn, gates 9.6 volts to PL tone gate Q703, turning it off. When Q703 is turned off, only the output of Q701 is coupled to emitter follower Q704. When the transmitter is unkeyed, Q709 is turned off and Q703 is turned on which completes the tone path from Q702 to C703. The two tone signals 180° out of phase, combine through the phase shift capacitors to produce a signal to the emitter follower that is 240° out of phase with the original tone. Emitter follower Q704 provides impedance matching in a low impedance ouput and isolates the tone oscillator from the external circuit to which the tone output is applied.

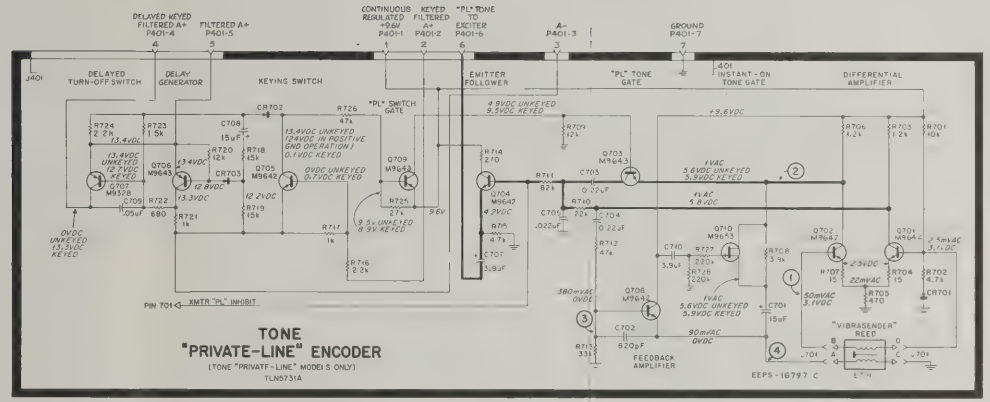
EPS-17757-B

TONE "PL" ENCODER WAVEFORMS

OSCILLOSCOPE WAVEFORMS MEASURED UNDER FOLLOWING CONDITIONS

1. WAVEFORMS SHOWN USING 100 Hz 'VIBRASENDER' RESONANT REED
2. VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM
3. HORIZONTAL DEFLECTION = 5 msec/DIV
4. ALL WAVEFORMS MEASURED IN RESPECT TO CHASSIS GROUND





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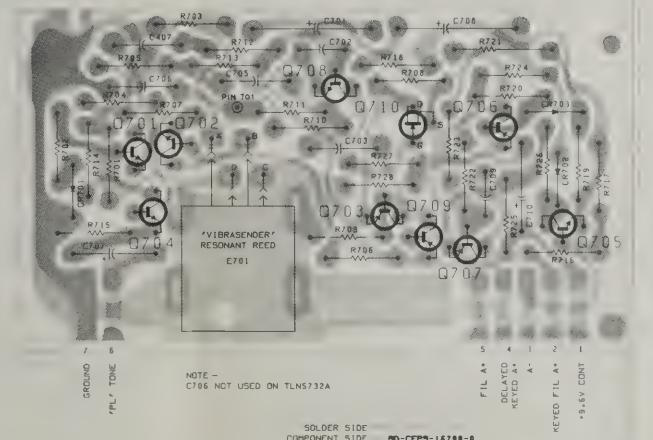

"PL" ENCODER

701. ALL AC VOLTAGE MEASUREMENTS ARE RMS VALUES ALL AC VOLTAGES ARE SINUSOIDAL EXCEPT Q708 EMITTER. METER READING DEPENDENT UPON METER RESPONSE TO NON-SINUSOIDAL WAVE.

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703. UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN PICOFARADS. RESISTOR VALUES ARE IN OHMS.

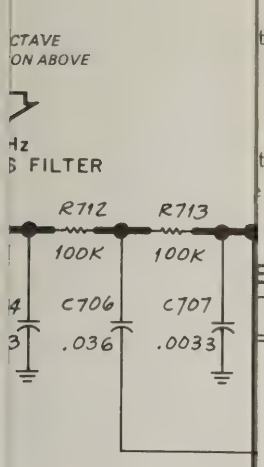
704. PIN 701 IS USED ONLY FOR CERTAIN OPTIONAL EQUIPMENT

705. PINS J401-6 AND -7 ON THE PL ENCODER MATE WITH PINS P401-11 AND -12 ON THE EXCITER

NEPS-7051-B

SIMPLEX "DIGITAL PRIVATE-LINE" ENCODER

MODEL TTN6003A



th Simplex "Digital Private-Line" Binary-Coded Squelch.

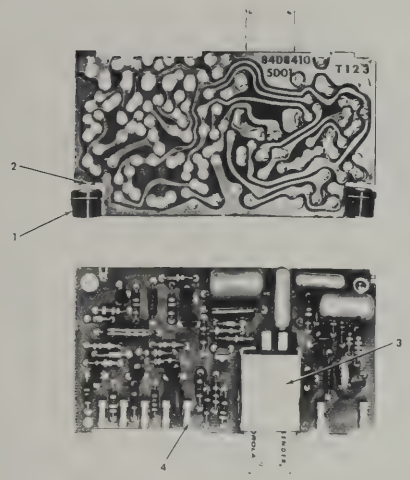
generator (located on "Digital Private-Line" Decoder Board) to the exciter,
tive filter for 23-bit binary code word.
yed A+ (180 millisecond transmitter turn-off delay.

"DIGITAL PRIVATE-LINE" ENCODER BOARD TROUBLESHOOTING CHART

	PROBABLE CAUSES	ACTION
	1. No keyed A+ to encoder board (pin 2).	Check keyed A+ at pin 10 of P902 on exciter board
	2. Malfunction in delayed keyed A+ generation circuitry.	Check delayed turn-off switch, delay generator and keying switch operation on encoder board.
	Malfunction in delayed keyed A+ circuits.	Check C710. Then check delay generator circuit.
t	1. No input to encoder board pin 6 from decoder board.	On decoder board, check U801-5 for code signal. Check for 6.0 V dc at U801-24. If 6.0 V dc is present, check 50 kHz clock for proper operation (U801-4). If clock is ok, replace U801.
	2. Faulty inverter (Q702)	Check inverter operation.
	3. Active filter malfunction	Check Q703, Q704 operation.
	U801 code generator on decoder board is not switching.	On decoder board, ground U801-9. If code is still present at U801-5, check 50 kHz clock output (U801-4). If clock is ok, replace U801.
hen	U801 code generator on decoder board is not switching.	Apply +9.6 V at J805 on decoder board. If turn-off code is still present at U801-5, replace U801.
	1. Code deviation is greater than ±1 kHz	Check for proper waveform amplitude at encoder board pin 10 (Xmit code out).
	2. Low pass active filter is not switching from 140 Hz to 85 Hz.	Replace Q705.
er.	1. No turn-off code is being transmitted.	Check the delayed keyed A+ duration (170-250 msec). Then check U801-5 on decoder board for presence of the turn-off code.
	2. Low pass active filter is always switched low (85 Hz).	Replace Q705.
	Wrong code is being transmitted.	Feed U801-5 from decoder board into a Motorola Model SLN6413A "Digital Private-Line" test set. Check for proper decode. If proper decode is not obtained. Check for an intermittent or bad code plug (TRN6005A) or resistor network (Z801) on the decoder board. Check U801-15 thru U801-23 for a proper octal code.

TONE "PRIVATE-LINE" ENCODER

MODEL TLN5731A



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MECHANICAL PARTS LIST

TLN5731A and TLN4293B "Private-Line" Encoder PL-1308-D

CODE	MOTOROLA PART NO.	DESCRIPTION
1	42-84284B01	RETAINER, screw: 2 req'd
2	3-138162	LOCKSCREW, tapping: No 4 x 3/8" Phillips hex head; 2 req'd
3	42-84116B02	SOCKET & BRACKET ASSEMBLY: for "Vibrasender" Resonant Reed
4	9-83011H01	TERMINAL, pin: female 7 req'd

68P81026E71-F
(Sheet 2 of 2)
8/15/77-NPC

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

ELECTRICAL PARTS LIST

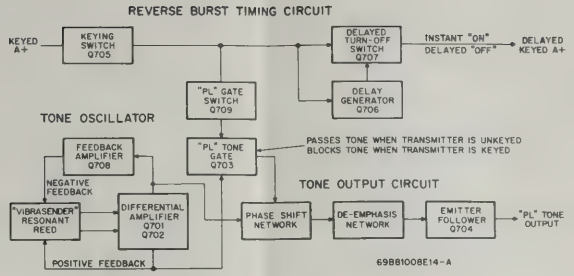
TLN5731A Tone "Private-Line" Encoder PL-3260-C

		CAPACITOR, fixed: uF; ±10%; 50 V; unless otherwise stated
C701	23-847o2H09	15 ±20%, 20 V
C702	21-82187B23	820 pF; 500 V
C703, 704	8-82905G32	0.22
C705	8-83813H08	.022
C706		NOT USED
C707	23-847o2H08	3.9 uF ±20%; 15 V
C708	23-83214C26	15; 25 V
C709	21-82372C04	.05; +80-20%; 75 V
C710	23-847o2H08	3.9 uF ±20%; 15 V
		DIODE: (SEE NOTE I)
CR701, 702, 703	48-83654H01	silicon
		CONNECTOR, receptacle:
J401		consists of 7 female contact terminals (Part No. 9-83011H01) mounted on edge of circuit board
		'VIBRASENDER' RESONANT REED: (SEE NOTE II)
E701	TLN6824A	"plug-in" unit
		TRANSISTOR: (SEE NOTE I)
Q701, 702	48-869570	NPN; type M9570
	or 48-869642	NPN; type M9642
Q703	48-869571	PNP; type M9571
	or 48-869643	PNP; type M9643
Q704, 705	48-869570	NPN; type M9570
	or 48-869642	NPN; type M9642
Q706	48-869571	PNP; type M9571
	or 48-869643	PNP; type M9643
Q707	48-869328	PNP; type M9328
Q708	48-869570	NPN; type M9570
	or 48-869642	NPN; type M9642
Q709	48-869571	PNP; type M9571
	or 48-869643	PNP; type M9643
Q710	48-869653	FET; type M9653
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R701	6-124A73	10k
R702	6-124A65	4.7k
R703, 706	6-124A51	1.2k
R704	6-124A05	15
R705	6-124A41	470
R707	6-124A05	15
R708	6-124A63	3.9k
R709	6-124C75	12k ±10%
R710	6-124A81	22k
R711	6-124A95	82k
R712	6-124A89	47k
R713	6-124A85	33k
R714	6-124C35	270 ±10%
R715	6-124A65	4.7k
R716	6-124C57	2.2k ±10%
R717	6-124C49	1k ±10%
R718	6-124A53	1.5k
R719	6-124A77	15k
R720	6-124A75	12k
R721	6-125A49	1k
R722	6-124A45	680
R723	6-124A53	1.5k
R724	6-124C57	2.2k ±10%
R725	6-124C83	27k ±10%
R726	6-124C89	47k ±10%
R727, 728	6-124D06	220k ±10%

NOTES:

I. For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

II. The "Vibrasender" Resonant Reed (Model KLN6210A) is not a part of the encoder board. When ordering a complete board, the reed must be ordered separately.



MAINTENANCE

a. Recommended Test Equipment

(1) Motorola SLN6221A "Private-Line" Tone Generator -- used for testing "Vibrasender" resonant reeds.

(2) Motorola Solid-State AC Voltmeter -- used for tone level measurement.

(3) General purpose oscilloscope -- valuable for signal tracing and locating sources of distortion.

(4) Motorola Solid-State DC Multimeter -- used for dc voltage measurement.

(5) Motorola S1343 Series Frequency Counter or S1344 Series Frequency Counter/Deviation Meter -- used for measuring PL tone frequency.

b. Performance Test

Measure frequency deviation of the transmitter in which the PL encoder is installed. With the transmitter keyed and PL tone modulation (only), deviation should read ±0.5 to ±1.0 kHz.

c. Troubleshooting

(1) If no deviation is measured the trouble may lie in the tone oscillator or tone output circuit. The trouble may be isolated by the following steps.

(a) Check 9.6-volt input to encoder.

(b) Check ac signal voltage at collector of Q701.

(c) If signal is present, check Q704.

(d) If no signal is present any component in the oscillator loop could cause the trouble. Check the "Vibrasender" resonant reed in the SLN6221A "Private-Line" Tone Generator.

(e) If the tone generator does not produce an output signal the reed is defective.

(f) If the reed is good, replace it in the encoder and make dc voltage measurement in the tone oscillator circuit to locate the defective components.

(2) If low deviation is measured, check ac signal voltages and compare them with the chart readings to find the source of trouble.

(3) If deviation is normal, but calls are not being received, check the frequency of the PL encoder tone. If off-frequency, replace the "Vibrasender" resonant reed.

(4) If squelch tail noise bursts are heard by all listening receivers, check dc voltages of Q703 and Q706 is keyed and unkeyed conditions.

(5) If the transmitter cannot be keyed, and the trouble has been isolated to the PL encoder board, measure dc voltages in Q705 and Q707 stages.

(6) If too much tone deviation is measured, check feedback amplifier Q708.

SIMPLEX "DIGITAL PRIVATE-LINE" ENCODER

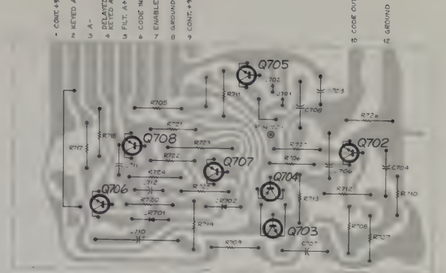
MODEL TTN6003A

APPLICATION

"Micor" Base Stations with Simplex 'Digital Private-Line' Binary-Coded Squelch.

FUNCTION --

1. Interfaces code word generator (located on "Digital Private-Line" Decoder Board) to the exciter, provides low pass active filter for 23-bit binary code word.
2. Generates delayed keyed A+ (180 millisecond transmitter turn-off delay.



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SOLDER SIDE

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REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

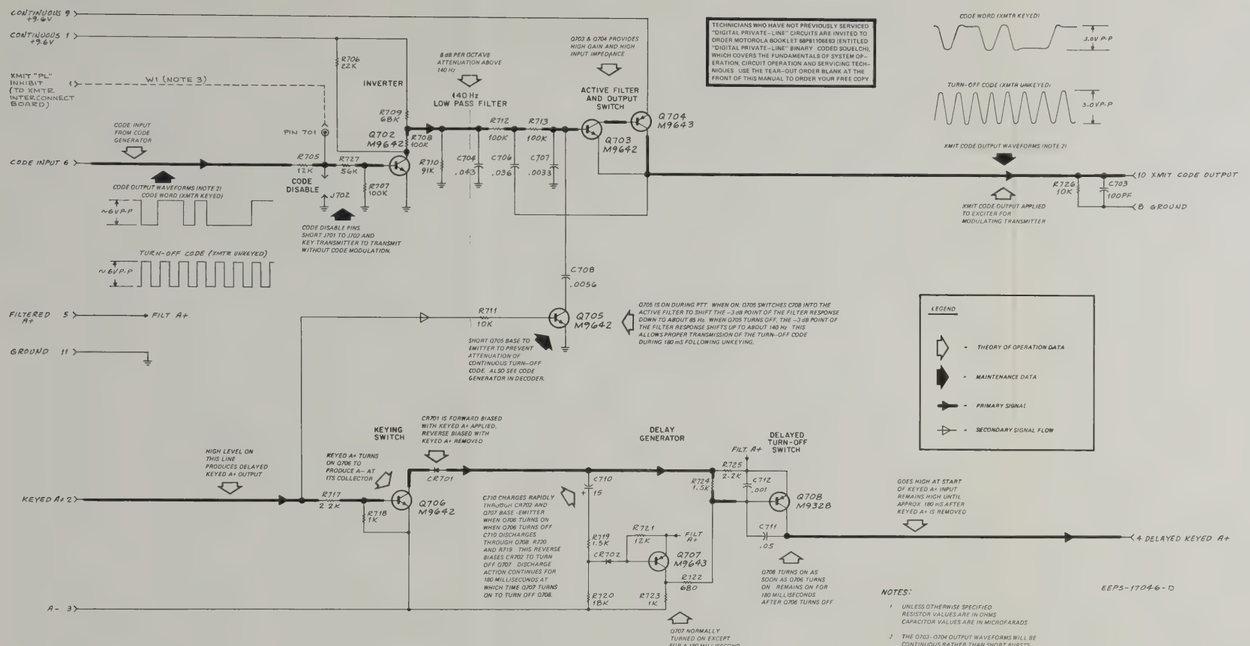
PARTS LIST

TTN6003A Encoder Board PL-3298-A

		CAPACITOR, fixed: uF:
C703	21-831125	100 pF ±10%; 300 V
C704	8-838138H14	.043 pF ±5%; 50 V
C706	8-838138H24	.036 ±5%; 50 V
C707	8-838138H27	.033 ±5%; 50 V
C708	8-838138H2n	.0056
C710	23-827813D24	15 ±10%; 25 V
C711	21-827ZC06	.05 +80-20%; 25 V
C712	21-8359nE13	.001 ±10%; 100 V
		DIODE: (SEE NOTE)
CR701, 702	48-83654H01	silicon
		TRANSISTOR: (SEE NOTE)
Q702, 703	4[illegible]-42	NPN; type M9642
Q704	4[illegible]-43	PNP; type M9643
Q705, 706	4[illegible]-42	NPN; type M9642
Q707	4[illegible]-43	PNP; type M9643
Q708	48-869328	PNP; type M9328
		RESISTOR, fixed: ±5%; 1/4 W unless otherwise stated
R[illegible]	6-124A75	12k
R[illegible]	6-124A81	22k
R707, 70[illegible]	6-124A97	100k
R709	6-124A93	n0k
R710	6-124A96	91k
R711	6-124A73	10k
R712, 713	6-124A97	100k
R[illegible]	6-124C57	2.2k ±10%
R[illegible]	6-124C69	1k ±10%
R[illegible]	6-124A53	1.5k
R[illegible]	6-124A79	18k
R[illegible]	6-124A75	12k
R[illegible]	6-124A45	n80
R[illegible]	6-124A49	1k
R[illegible]4	6-124A53	1.5k
R[illegible]	6-124C57	2.2k ±10%
R[illegible]	6-124A73	10k
R[illegible]	6-124A91	56k

NOTE:

For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.


CONTINUOUS +9.6V
CONTINUOUS +9.6V
XMIT "PL" INHIBIT (TO XMTR INTERCONNECT BOARD)
W1 (NOTE 3)
INVERTER
R706 22K
8 dB PER OCTAVE ATTENUATION ABOVE 140 Hz
140 Hz LOW PASS FILTER
Q703 & Q704 PROVIDES HIGH GAIN AND HIGH INPUT IMPEDANCE
ACTIVE FILTER AND OUTPUT SWITCH
Q704 M9643
Q703 M9642
Q702 M9642
R708 100K
R709 68K
R710 91K
R712 100K
R713 100K
C706 .043
C704 .036
C707 .0033
C708 .0056
PIN 701
CODE INPUT FROM CODE GENERATOR
CODE INPUT 6
R705 15K CODE DISABLE
J702
R727 56K
R707 100K
CODE DISABLE PINS SHORT J701 TO J702 AND KEY TRANSMITTER TO TRANSMIT WITHOUT CODE MODULATION.
CODE OUTPUT WAVEFORMS (NOTE 2) CODE WORD (XMTR KEYED)
~6V P-P
TURN-OFF CODE (XMTR UNKEYED)
~6V P-P
FILTERED A+ 5
FILT A+
GROUND 11
R711 10K
Q705 M9642
SHORT Q705 BASE TO EMITTER TO PREVENT ATTENUATION OF CONTINUOUS TURN-OFF CODE. ALSO SEE CODE GENERATOR IN DECODER.
Q705 IS ON DURING PTT. WHEN ON, Q705 SWITCHES C708 INTO THE ACTIVE FILTER TO SHIFT THE -3 dB POINT OF THE FILTER RESPONSE DOWN TO ABOUT 85 Hz. WHEN Q705 TURNS OFF, THE -3 dB POINT OF THE FILTER RESPONSE SHIFTS UP TO ABOUT 140 Hz. THIS ALLOWS PROPER TRANSMISSION OF THE TURN-OFF CODE DURING 180 mS FOLLOWING UNKEYING.
KEYING SWITCH
CR701 IS FORWARD BIASED WITH KEYED A+ APPLIED. REVERSE BIASED WITH KEYED A+ REMOVED
HIGH LEVEL ON THIS LINE PRODUCES DELAYED KEYED A+ OUTPUT
KEYED A+ TURNS ON Q706 TO PRODUCE A- AT ITS COLLECTOR
CR701
R717 2.2K
R718 1K
Q706 M9642
KEYED A+ 2
A- 3
DELAY GENERATOR
C710 CHARGES RAPIDLY THROUGH CR702 AND Q707 BASE - EMITTER WHEN Q706 TURNS ON. WHEN Q706 TURNS OFF, C710 DISCHARGES THROUGH R719, R720 AND R719. THIS REVERSE BIASES CR702 TO TURN OFF Q707. DISCHARGE ACTION CONTINUES FOR 180 MILLISECONDS AT WHICH TIME Q707 TURNS ON TO TURN OFF Q708.
C710 15
R719 1.5K
CR702
R720 18K
R721 12K
Q707 M9643
R722 680
R723 1K
Q707 NORMALLY TURNED ON EXCEPT FOR A 180 MILLISECOND PERIOD AFTER UNKEYING. WHEN TURNED ON COLLECTOR VOLTAGE HOLDS Q708 OFF PROVIDED Q706 IS TURNED OFF
DELAYED TURN-OFF SWITCH
FILT. A+
R725 2.2K
R724 1.5K
C712 .001
Q708 M9328
C711 .05
Q708 TURNING ON AS SOON AS Q706 TURNS ON. REMAINS ON FOR 180 MILLISECONDS AFTER Q706 TURNS OFF
GOES HIGH AT START OF KEYED A+ INPUT. REMAINS HIGH UNTIL APPROX. 180 mS AFTER KEYED A+ IS REMOVED
4 DELAYED KEYED A+
C703 .100PF
10 XMIT CODE OUTPUT
R728 10K
B GROUND
XMIT CODE OUTPUT WAVEFORMS (NOTE 2)
XMIT CODE OUTPUT APPLIED TO EXCITER FOR MODULATING TRANSMITTER
CODE WORD (XMTR KEYED)
3.6V P-P
TURN-OFF CODE (XMTR UNKEYED)
3.0V P-P
LEGEND
- THEORY OF OPERATION DATA
- MAINTENANCE DATA
- PRIMARY SIGNAL
- SECONDARY SIGNAL FLOW
EEPS-17046-O

TECHNICIANS WHO HAVE NOT PREVIOUSLY SERVICED "DIGITAL PRIVATE-LINE" CIRCUITS ARE INVITED TO ORDER MOTOROLA BOOKLET (68P81106E63) (ENTITLED "DIGITAL PRIVATE-LINE" BINARY CODED SQUELCH), WHICH COVERS THE FUNDAMENTALS OF SYSTEM OPERATION, CIRCUIT OPERATION AND SERVICING TECHNIQUES. USE THE YEAR-DOT ORDER BLANK AT THE FRONT OF THIS MANUAL TO ORDER YOUR FREE COPY.

NOTES:

1. UNLESS OTHERWISE SPECIFIED RESISTOR VALUES ARE IN OHMS CAPACITOR VALUES ARE IN MICROFARADS
2. THE Q703-Q706 OUTPUT WAVEFORMS WILL BE CONTINUOUS RATHER THAN SHORT BURSTS. THE SAMPLE CODE WAVEFORM SHOWN IS ONLY A SMALL PORTION OF THE OVERALL
3. CABLE W1 IS PART OF PAGING OPTION

"DIGITAL PRIVATE-LINE" ENCODER BOARD TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSES	ACTION
No delayed keyed A+ to exciter board.	1. No keyed A+ to encoder board (pin 2).	Check keyed A+ at pin 10 of P902 on exciter board
	2. Malfunction in delayed keyed A+ generation circuitry.	Check delayed turn-off switch, delay generator and keying switch operation on encoder board.
Delayed keyed A+ remains high less than 160 msec or longer than 220 msec after unkeying.	Malfunction in delayed keyed A+ circuits.	Check C710. Then check delay generator circuit.
No Output on Xmit code out (pin 10), keyed or unkeyed.	1. No input to encoder board pin 6 from decoder board.	On decoder boa[illegible] for code signal. Check for o[illegible] at U801-24. If 6.0 V dc is pr[illegible], check 50 kHz clock for proper operation (U801-4). If clock is ok, replace U801.
	2. Faulty inverter (C702)	Check inverter operat[illegible].
	3. Active filter malfunction	Check Q703, Q704 co[illegible].
Code (not turn-off code) is on encoder board pin 10 when the radio is unkeyed.	U801 code generator on decoder board is not switching.	On decoder board, [illegible] U801-9. If code is still present at U801-5, check 50 kHz clock output (U801-4). If clock is ok, replace U801.
Turn-off code (not code) is on encoder board pin 10 when the radio is keyed. Excessive "code sound" heard at the speaker of radio listening to this transmitter.	U801 code generator on decoder board is not switching.	Apply 49.6 V at [illegible] on decoder board. If turn-[illegible]ode is still present at U801-5, replace U801.
	1. Code deviation is greater than ±1 kHz	Check for proper waveform amplitude at encoder board pin 10 (Xmit code out).
	2. Low pass active filter is not switching from 140 Hz to 85 Hz.	Replace Q705.
Squelch tails are heard at the speaker of a radio listening to this transmitter.	1. No turn-off code is being transmitted.	Check the delayed keyed A+ duration (170-250 msec). Then check U801-5 on decoder board for presence of the turn-off code.
	2. Low pass active filter is always switched low (85 Hz).	Replace Q705.
No other radios in the system are enabled by this transmitter; code is being transmitted.	Wrong code is being transmitted.	Feed U801-5 from decoder board into a Motorola Model SLN6413A "Digital Private-Line" test set. Check for proper decode. If proper decode is not obtained. Check for an intermittent or bad code plug (TRN6005A) or resistor network (Z801) on the decoder board. Chec[illegible] U801-15 thru U801-23 for a proper octal code.

68P81102E63-B
12/18/76-NPC

CONDENSED CONTENTS

TAB 1

DESCRIPTION
INSTALLATION
MAINTENANCE

TAB 2

EXCITER/1ST BANDPASS FILTER
TRIPLER AND DOUBLER
INTERMEDIATE POWER AMPLIFIER
DIRECTIONAL COUPLER
POWER CONTROL BOARD
FINAL POWER AMPLIFIER
TRANSMITTER INTERCONNECT BOARD
TONE "PL" ENCODER
"DIGITAL PL" ENCODER (SIMPLEX)
"DIGITAL PL" ENCODER (DUPLEX)

TAB 3

RF AND I–F DECK
AUDIO AND SQUELCH BOARD
AUDIO POWER AMPLIFIER
TONE "PL" DECODER
"DIGITAL PL" DECODER

TAB 4

HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY

DUPLEX "DIGITAL PRIVATE-LINE" ENCODER

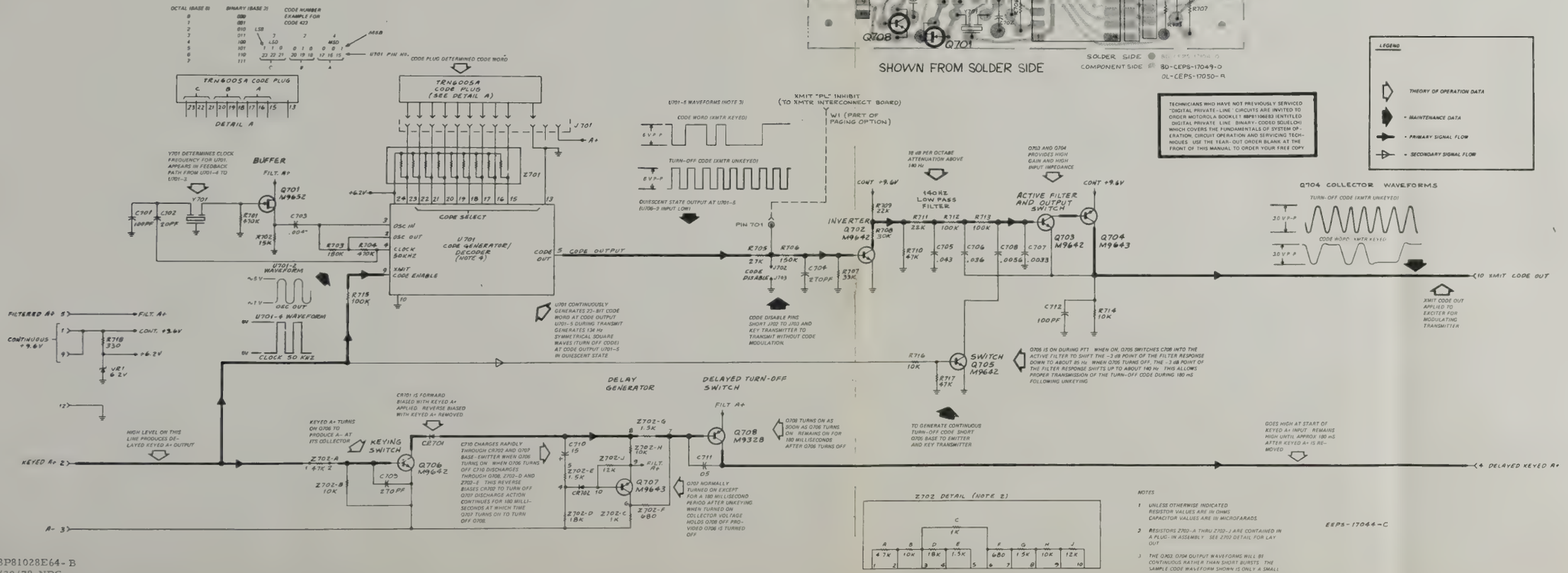
MODEL TLN5725A

APPLICATION --

"Micor" Base Stations & Repeaters

FUNCTION --

Generates "Digital Private-Line" Code for transmitter in duplex applications (where decoder and encoder may be on simultaneously). Develops 180 mS transmitter turn-off delay (delayed keyed A+).


DELAYED KEYED A+
KEYED A+
FILT. A+
+9.6V
XMIT CODE OUT
GND
SHOWN FROM SOLDER SIDE
SOLDER SIDE
COMPONENT SIDE
80-CEPS-17049-O
OL-CEPS-17050-R
TRN6005A CODE PLUG
DETAIL A
TRN6005A CODE PLUG (SEE DETAIL A)
BUFFER
CODE SELECT
U701 CODE GENERATOR/ DECODER (NOTE 4)
XMIT CODE ENABLE
CODE OUT
XMIT "PL" INHIBIT (TO XMTR INTERCONNECT BOARD)
W1 (PART OF PAGING OPTION)
CODE WORD (XMTR KEYED)
TURN-OFF CODE (XMTR UNKEYED)
QUIESCENT STATE OUTPUT AT U701-5 (U706-3 INPUT LOW)
INVERTER Q702 M9642
140 Hz LOW PASS FILTER
ACTIVE FILTER AND OUTPUT SWITCH
Q703 M9642
Q704 M9643
Q704 COLLECTOR WAVEFORMS
TURN-OFF CODE (XMTR UNKEYED)
CODE WORD XMTR KEYED
10 XMIT CODE OUT
XMIT CODE OUT APPLIED TO EXCITER FOR MODULATING TRANSMITTER
CODE DISABLE PINS SHORT J702 TO J703 AND KEY TRANSMITTER TO TRANSMIT WITHOUT CODE MODULATION
SWITCH Q705 M9642
TO GENERATE CONTINUOUS TURN-OFF CODE SHORT Q705 BASE TO EMITTER AND KEY TRANSMITTER
DELAY GENERATOR
DELAYED TURN-OFF SWITCH
KEYING SWITCH
Q706 M9642
Q707 M9643
Q708 M9328
HIGH LEVEL ON THIS LINE PRODUCES DELAYED KEYED A+ OUTPUT
KEYED A+ TURNS ON Q706 TO PRODUCE A- AT ITS COLLECTOR
GOES HIGH AT START OF KEYED A+ INPUT. REMAINS HIGH UNTIL APPROX 180 mS AFTER KEYED A+ IS REMOVED
6 DELAYED KEYED A+
Z702 DETAIL (NOTE 2)
LEGEND
THEORY OF OPERATION DATA
MAINTENANCE DATA
PRIMARY SIGNAL FLOW
SECONDARY SIGNAL FLOW
TECHNICIANS WHO HAVE NOT PREVIOUSLY SERVICED "DIGITAL PRIVATE-LINE" CIRCUITS ARE INVITED TO ORDER MOTOROLA BOOKLET 68P81066B83 (ENTITLED DIGITAL PRIVATE LINE (BINARY-CODED SQUELCH) WHICH COVERS THE FUNDAMENTALS OF SYSTEM OPERATION, CIRCUIT OPERATION AND SERVICING TECHNIQUES. USE THE TEAR-OUT ORDER BLANK AT THE FRONT OF THIS MANUAL TO ORDER YOUR FREE COPY.
EEPS-17044-C

68P81028E64-B
3/30/78-NPC

PARTS LIST

TLN5725A Encoder Board — Pl.-3300-O

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: uF:
C701	21-82610C58	100 pF ±10%; 100 V
C702	21-82133G24	20 pF ±5%; 500 V
C703	21-82428B09	.0047 ±10%; 100 V
C704, 709	21-82187B22	270 pF ±10%; 200 V
C705	8-83813H14	.043 ±5%; 50 V
C706	8-83813H24	.036 ±5%; 50 V
C707	8-83813H27	.0033 ±5%; 50 V
C710	23-82783B24	15 ±10%; 25 V
C711	21-82372C04	.05 ±10%; 25 V
		DIODE: (SEE NOTE)
CR701, 702	48-83654H01	silicon
		TRANSISTOR: (SEE NOTE)
Q701	48-869652	field-effect; M9652
Q702, 703, 705, 706	48-869642	NPN; type M9642
Q704, 707	48-869643	PNP; type M9643
Q708	48-869328	PNP; type M9328
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R701, 704	6-124D14	470k ±10%
R702	6-124C77	15k ±10%
R703	6-124D04	180k ±10%
R705	6-124A83	27k
R706	6-124B02	150k
R707	6-124C85	33k ±10%
R708	6-124A79	18k
R709, 711	6-124C81	22k ±10%
R710, 717	6-124A89	47k
R712, 713	6-124A97	100k
R714	6-124A73	10k
R715	6-124C97	100k ±10%
R716	6-124C73	10k ±10%
R718	6-124C37	330 ±10%
		INTEGRATED CIRCUIT: (SEE NOTE)
U701	51-84267A82	type M6782
		VOLTAGE REGULATOR:
VR701	48-83696F07	Zener; 6.2 V
		CRYSTAL:
Y701	48-82003K01	resonator; 50.000 KC
		RESISTOR NETWORK:
Z701	1-80772B36 or 51-82142K02	pull-up, 10-pin
Z702	1-80772B35 or 51-82142K01	push-to-talk, 10-pin

NOTE: For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.

CONDENSED CONTENTS

TAB 1

DESCRIPTION
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TAB 2

EXCITER/1ST BANDPASS FILTER
TRIPLER AND DOUBLER
INTERMEDIATE POWER AMPLIFIER
DIRECTIONAL COUPLER
POWER CONTROL BOARD
FINAL POWER AMPLIFIER
TRANSMITTER INTERCONNECT BOARD
TONE "PL" ENCODER
"DIGITAL PL" ENCODER (SIMPLEX)
"DIGITAL PL" ENCODER (DUPLEX)

TAB 3

RF AND I–F DECK
AUDIO AND SQUELCH BOARD
AUDIO POWER AMPLIFIER
TONE "PL" DECODER
"DIGITAL PL" DECODER

TAB 4

HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY

"MICOR" "SENSITRON" 800 MHz RECEIVER RF & IF BOARD

MODEL TRF1011C

MODEL TABLE

ODEL	MODEL BREAKDOWN	DESCRIPTION
F1011C	TLF6021A TRF6011C TRN6713A TLF6163A	RF Deck Receiver RF and IF Board Second Oscillator Quadrupler

ERISTICS

C	806-821 MHz
	25 kHz
	±8 kHz minimum
	Channel element maintains receiver frequency within ±0.0002% of reference frequency from -30°C to +60°C ambient temperature (+25°C reference).
	50 ohms
NG	0.5 uV
	0.35 uV
	-80 dB @ ±25 kHz
	-75 dB
	100 dB minimum
djustable)	.25 uV or less at threshold
	.25 uV or less
	.25 uV or less

68P81037E04-B
3/30/78-NPC

RECEIVER ALIGNMENT PROCEDURE

A. FREQUENCY CALCULATIONS

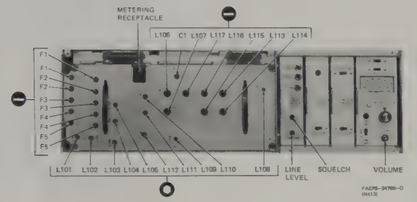
Where:

f_o = channel element frequency

f_c = carrier frequency

$$f_o = \frac{f_c - 45\ \text{MHz}}{48}$$

B. RECEIVER ADJUSTMENT LOCATIONS



C. MINIMUM RECEIVER METER READINGS

(NO INPUT SIGNAL APPLIED)

TEST SET SELECTOR SWITCH POSITION	READING (uA)	CIRCUIT METERED
1	10	Channel Element Output
2	15	First Doubler Output
3	10	Second Doubler Output
4+,4-	0 ±2	Discriminator Output
5	10	Second IF Amplifier and Limiter

D. RECEIVER ALIGNMENT

Step	Adjust	Meter Position	Stage and Procedure
1	L101, L102, L103, L104, L105		MULTIPLIER COILS - Adjust the cores of L101, L102, L103, and L105 to the end of the coil form flush with the printed circuit board. Adjust the core of L104 to the end of the coil form away from the printed circuit board.
2	L110, L111, L112		FIRST IF COILS - Adjust the cores of L110, L111, and L112 to the end of the coil form flush with the printed circuit board.
3	L106, L107, L113, L114, L115, L116, L117		PRESELECTOR AND INJECTION FILTER - Adjust the slugs at L106, L107, and L113 through L117 away from the rf deck until they stop. Adjust L106 four turns clockwise and L117 two turns clockwise.
4	L101, L102	1	CHANNEL ELEMENT OUTPUT - Adjust L102 two turns clockwise. Alternately turn L101 and L102 clockwise 1/2 turn at a time until a peak indication is achieved on meter 1.
5	L103, L104	2	FIRST DOUBLER - Tune L103 for a peak reading on meter 2. Tune L104 counterclockwise until meter 2 dips.
6	L104, L105	3	QUADRUPLER - Tune L105 clockwise until a peak reading is achieved on meter 3. Tune L104 until a peak reading is achieved on meter 3. Repeak L104 and L105 until no further improvement is obtained.
7	L108	4, 5	DISCRIMINATOR - Insert the center conductor of the output cable from a 11.7 MHz test oscillator into the L109 hole on the receiver shield. Do not contact the circuit board. Insert the conductor far enough to obtain a saturated reading on meter 5. By tuning L108, it should then be possible to obtain readings on either side of zero (center) on meter 4. Tune L108 for an EXACT zero (center) reading. This adjustment is critical.
8	L109	5	SECOND IF COIL - Insert the 11.7 MHz injection probe into the L112 hole in the receiver shield. Tune L109 for a peak reading on meter 5, keeping meter 5 out of saturation by moving the probe.
9	C1	4, 5	SECOND OSCILLATOR WARP CAPACITOR - Insert the 45 MHz injection probe into the L112 hole in the receiver shield. Tune C1 until quieting is obtained and meter 5 increases. Tune C1 for an EXACT zero reading on meter 4. This adjustment is critical.
10	L110, L111, L112	5	FIRST IF COILS - Insert the 45 MHz injection probe in the L110 hole on the receiver shield. Tune L112 clockwise for a peak reading on meter 5, keeping the meter out of saturation by moving the probe. Tune L111 clockwise for a peak reading on meter 5, keeping the meter out of saturation. Remove the probe and turn L110 ten turns clockwise.
11	L106	4, 5	INJECTION FILTER - Unsquelch the receiver and connect an rf signal generator to the antenna connector. Set the rf output level of the generator to maximum and set the generator to the carrier frequency. Tune L106 for peak reading on meter 5, reducing the generator level as necessary to keep meter 5 out of saturation.
12	L107, L105, L104	3, 5	Detune L105 until meter 3 drops to 10 uA. Tune L107 for a peak reading on meter 5. Tune L105 for a peak reading on meter 3. Repeak L104 and L105 until no further improvement is obtained.
13	L113, L114 L115, L116, L117	5	RF PRESELECTOR - Tune L117, L116, L113, L114 and L115 in that order for a peak reading on meter 5. Reduce the generator level as necessary to keep meter 5 out of saturation.

D. RECEIVER ALIGNMENT (Cont'd.)

Step	Adjust	Meter Position	Stage and Procedure
14	L113, L114, L115, L116, L117	5	Tune L113, L114, L115, L116, L117 in that order for best noise quieting.
15	L110, L111, L112, L109	5	FM modulate the carrier frequency with a 1 kHz tone at 7.5 kHz deviation. Peak L110, L111, L112, and L109 in that order for a maximum reading on meter 5.
16	F1	4	Adjust F1 channel element. Inject a known, accurate carrier frequency into the receiver. Adjust the channel element warp capacitor for a zero reading on meter position 4.
17	–	–	Perform 20 dB quieting sensitivity measurements to check alignment.

"MICOR" "SENSITRON" 800 MHz RECEIVER RF & IF BOARD

MODEL TRF1011C

MODEL TABLE

MODEL	MODEL BREAKDOWN	DESCRIPTION
TR [illegible]011C	TLF6021A	RF Deck
	TRF6011C	Receiver [illegible]
	TRN6713A	[illegible]
	TLF6163A	[illegible]

TECHNICAL CHARACTERISTICS

RF FREQUENCY RANGE		806-821 MHz
CHANNEL SPACING		[illegible] MHz
EIA MODULATION ACCEPTANCE		±8 kHz [illegible]
FREQUENCY		Channel element maintains ±0.0002% of reference frequency from -30°C to +60°C ambient temperature (+25°C reference).
INPUT IMPEDANCE		50 ohms
SENSITIVITY	20 dB QUIETING	0.5 uV
	EIA SINAD	0.35 uV
SELECTIVITY (EIA SINAD)		-80 dB @ ±25 kHz
EIA SINAD INTERMODULATION		-75 dB
SPURIOUS AND IMAGE REJECTION		100 dB minimum
SQUELCH SENSITIVITY CARRIER SQUELCH (adjustable)		.25 uV or less at threshold
TONE-CODED SQUELCH		.25 uV or less
DIGITAL-CODED SQUELCH		.25 uV or less

hree differential amplifier stages
·nally voltage regulated and temp-
›ensated. Isolation between the
is provided internally.

ND FOUR-POLE CRYSTAL FILTER

econd four-pole crystal filter esta-
receiver selectivity and operates
the first four-pole crystal filter
escribed. The filtered signal is
second i-f amplifier.

ND IF AMPLIFIER AND LIMITER

econd i-f amplifier and limiter con-
with associated discrete components
amplification and limiting functions.

differential amplifiers with internal
ation and temperature compensation
l. The first two differential ampli-
approximately 55 dB gain. The
output provides metering and is
third stage. This third stage,
e fourth stage, becomes overdriven
cellent symmetrical limiting char-
Full limiting occurs regardless of
th.

imited output of the second i-f ampl-
ed to the discriminator. Since am-
ow been made constant, the discrim-
normally would respond to both am-
requency variations, will produce
y demodulation.

ENANCE

ODUCTION

section provides maintenance pro-
he receiver rf and i-f board. These
onsist of tests which include meter-
nents and testing and troubleshooting
hat include integrated circuit checks.

NOTE

eceiver rf and i-f board must
talled in a receiver chassis
sting to provide the necessary
, ground, control and signal
ctions. The board should al-
be secured in place with all
ing screws for operation and
g to provide a good rf ground
stages of the receiver.

3.2 PERFORMANCE TESTS

3.2.1 General

Use the following tests to determine if the receiver rf and i-f board is operating properly. If testing produces unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart (diagram PEPS-24796).

3.2.2 No-Signal Meter Reading Test

A failure in any part of the rf and i-f board will usually result in improper meter readings at one or more test positions. Perform checks at meter positions 1 through 5 and compare the results with values shown in Table 1.

Table 1. Minimum Receiver RF & IF Meter Readings (No Input Signal Applied)

SELECTOR SWITCH POSITION	READING (MICRO-AMPS)	CIRCUIT METERED
1	10	Channel element output
2	15	First Doubler output
3	10	Second Doubler output
4+, 4-	0 ±2	Discriminator output
5	10	Second i-f amplifier and limiter

3.2.2.1 Using the Portable Test Set

Step 1. The receiver rf and i-f board must be installed in a complete receiver chassis for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

Step 3. Apply ac input power to the receiver.

Step 4. Using a TEK-37 Adapter Cable, connect a Motorola portable test set or meter panel to the receiver as follows:

--Connect the adapter cable 20-pin connector to the receptacle on the front of the test set or meter panel.

--Connect the adapter cable 7-pin white "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Set the portable test set switches as follows:

posi
e signal
when the
n. It
OFF
e gener-
4 as the
100
SEN
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e normal.

the receiver rf and i-f
be checked by dc voltage
voltages are shown in

iver Integrated Circuit
ltages
volts dc, measured
to chassis)

1 GE	U602 VOLTAGE
0	2.8
0	GND
9	2.9
6	6.6
9	9.3
7	7.2
6	6.4
9	2.9
9	2.9
0	GND

vary ±10% from nomi-
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Measurements

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an be located by measur-
s and performing crystal

E

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good conductive path
eter test should in-
m between the crys-
eiver circuit board
d ground connection
gain measurements.

alignment is essential
lete receiver rf and i-f
alignment. Leave alignment test equipment connected to perform this check.

Step 2. Refer to receiver gain measurements in Table 3, the rf and i-f schematic diagram, and the rf and i-f circuit board detail.

NOTE

Receiver rf input voltages given in Table 3 are those at the receiver input connector. If a pad or other attenuator is connected between the signal generator and the receiver rf input, the signal generator output control must be set to compensate for the loss in the pad.

EXAMPLES:

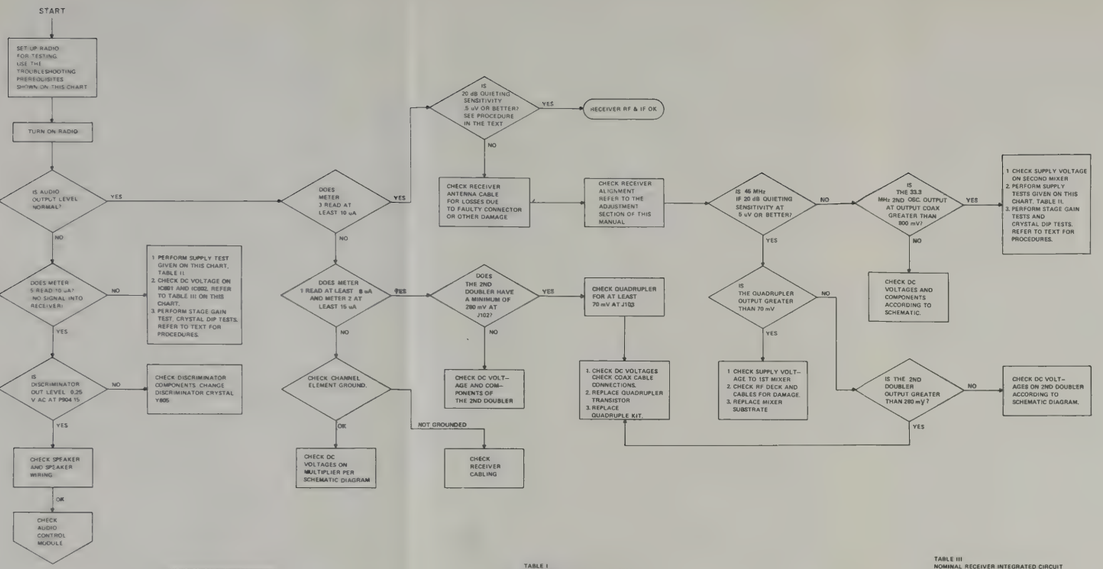
6 dB loss means V out of the pad = 1/2 V into the pad.

20 dB loss means V out of the pad = 1/10 V into the pad.

Step 3. Set the signal generator output frequency to the receiver channel frequency ("0" reading on meter 4). Adjust the signal generator output to provide the required receiver input voltage for a particular test point as listed in the table. Then, using an rf voltmeter, measure the rf signal voltage between the test point and a nearby chassis ground point. When using a high impedance rf probe (see Table of Recommended Test Equipment), the measured voltage at every test point should be within ±6 dB of the value given in Table 3.

Table 3. Receiver Gain Measurements

TEST POINT (See rf & i-f circuit board detail	RECEIVER INPUT VOLTAGE (preset)	TEST POINT VOLTAGE (mV) ±6 dB	REMARKS
L	50 mV	180	
M	50 mV	250	
N	50 mV	600	
O	50 mV	575	
P	50 mV	550	
Q	50 mV	500	
R	50 mV	250	U601
S	50 mV	800	saturated
T	20 uV	400	output
U	20 uV	375	
V	20 uV	350	
W	20 uV	300	U602
X	20 uV	75	saturated
Y	0	1000	output


START
SET UP RADIO FOR TESTING. USE THE TROUBLESHOOTING PREREQUISITES SHOWN ON THIS CHART.
TURN ON RADIO.
IS AUDIO OUTPUT LEVEL NORMAL?
YES
NO
1. PERFORM SUPPLY TEST GIVEN ON THIS CHART, TABLE II.
2. CHECK DC VOLTAGE ON XQ801 AND XQ802. REFER TO TABLE III ON THIS CHART.
3. PERFORM STAGE GAIN TEST, CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES.
DOES METER 3 READ AT LEAST 8 uA WITH NO SIGNAL INTO RECEIVER?
NO
YES
IS DISCRIMINATOR OUT LEVEL 0.25 V AC AT P904-1?
NO
CHECK DISCRIMINATOR COMPONENTS. CHANGE DISCRIMINATOR CRYSTAL Y805.
YES
CHECK SPEAKER AND SPEAKER WIRING.
OK
CHECK AUDIO CONTROL MODULE.
DOES METER 3 READ AT LEAST 10 uA
YES
NO
DOES METER 1 READ AT LEAST 8 uA AND METER 2 AT LEAST 16 uA
YES
NO
CHECK CHANNEL ELEMENT GROUND.
OK
CHECK DC VOLTAGES ON MULTIPLIER PER SCHEMATIC DIAGRAM
NOT GROUNDED
CHECK RECEIVER CABLING
IS 20 dB QUIETING SENSITIVITY .5 uV OR BETTER? SEE PROCEDURE IN THE TEXT
YES
RECEIVER RF & IF OK
NO
CHECK RECEIVER ANTENNA CABLE FOR LOSSES DUE TO FAULTY CONNECTOR OR OTHER DAMAGE
CHECK RECEIVER ALIGNMENT REFER TO THE ADJUSTMENT SECTION OF THIS MANUAL
IS 46 MHz IF 20 dB QUIETING SENSITIVITY AT 5 uV OR BETTER?
NO
YES
IS THE QUADRUPLER OUTPUT GREATER THAN 70 mV
NO
YES
1. CHECK SUPPLY VOLTAGE TO 1ST MIXER
2. CHECK RF DECK AND CABLES FOR DAMAGE.
3. REPLACE MIXER SUBSTRATE
IS THE 2ND DOUBLER OUTPUT GREATER THAN 280 mV?
NO
YES
CHECK DC VOLTAGES ON 2ND DOUBLER ACCORDING TO SCHEMATIC DIAGRAM.
IS THE 33.3 MHz 2ND OSC OUTPUT AT OUTPUT COAX GREATER THAN 800 mV?
YES
NO
CHECK DC VOLTAGES AND COMPONENTS ACCORDING TO SCHEMATIC.
1. CHECK SUPPLY VOLTAGE ON SECOND MIXER
2. PERFORM SUPPLY TESTS GIVEN ON THIS CHART. TABLE II.
3. PERFORM STAGE GAIN TESTS AND CRYSTAL DIP TESTS. REFER TO TEXT FOR PROCEDURES.
DOES THE 2ND DOUBLER HAVE A MINIMUM OF 280 mV AT J107?
YES
NO
CHECK QUADRUPLER FOR AT LEAST 70 mV AT J112
1. CHECK DC VOLTAGES CHECK COAX CABLE CONNECTIONS.
2. REPLACE QUADRUPLER TRANSISTOR
3. REPLACE QUADRUPLE KIT.
CHECK DC VOLTAGES AND COMPONENTS OF THE 2ND DOUBLER

TROUBLESHOOTING PREREQUISITES

1. THE RECEIVER RF & IF BOARD MUST BE INSTALLED IN A COMPLETE RECEIVER FOR TESTING. BE SURE ALL CIRCUIT BOARD MOUNTING SCREWS ARE SECURE, SHIELDS INSTALLED, AND THAT ALL CONNECTIONS TO THE BOARD ARE PROPERLY MADE.
2. USING A TEK-37 ADAPTER CABLE, CONNECT A MOTOROLA PORTABLE TEST SET OR METER PANEL TO THE RADIO AS FOLLOWS
   A. CONNECT THE ADAPTER CABLE 20-PIN CONNECTOR TO THE RECEPTACLE ON THE FRONT OF THE TEST SET OR METER PANEL.
   B. CONNECT THE WHITE "METERING" PLUG TO THE METERING RECEPTACLE ON THE RECEIVER RF AND IF BOARD.
3. SET PORTABLE TEST SET SWITCHES AS FOLLOWS
   A. FUNCTION SWITCH TO THE RCVR POSITION
   B. METER REVERSING SWITCH TO OFF POSITION
   C. ADAPTER CABLE SENS SWITCH TO THE 100 mV POSITION. IF THE ADAPTER CABLE HAS NO SENS SWITCH, THE UNIT OPERATES AT 100 mV ALL OF THE TIME.
   D. ADAPTER CABLE REFERENCE SWITCH TO POSITION A OR B.
   E. D. SELECTOR SWITCH AS REQUIRED BY THE TROUBLESHOOTING PROCEDURE
4. ON "PRIVATE-LINE" RADIOS, DISABLE THE PL MODULE.
5. SET THE SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED).
6. SET THE VOLUME CONTROL FOR A COMFORTABLE LISTENING LEVEL.
7. HIGH RF FREQUENCY MEASUREMENTS SHOULD BE MADE WITH AN ACCURATE METER SUCH AS THE MOTOROLA S1339A (SEE EQUIPMENT LIST).

TABLE I
MINIMUM RECEIVER RF & IF METER READINGS TABLE
(NO INPUT SIGNAL APPLIED)

SELECTOR SWITCH POSITION	READING (MICRO-AMPS)	CIRCUIT METERED
1	8	CHANNEL ELEMENT OUTPUT
2	15	FIRST DOUBLER OUTPUT
3	10	SECOND DOUBLER OUTPUT
4	0 ± 2	DISCRIMINATOR OUTPUT
5	10	SECOND I-F AMPLIFIER AND LIMITER

TABLE II
RECEIVER RF & IF DC INPUT VOLTAGES

TEST POINT	DESCRIPTION
P904-9	B+ CONTINUOUS (+13.8 V DC WITH REFERENCE TO CHASSIS)
P904-11	9.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)
P904-8,8	8.6 V DC CONTINUOUS (WITH REFERENCE TO CHASSIS) (±0.5 V)

TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES
(ALL READINGS ARE IN VOLTS DC, MEASURED WITH RESPECT TO CHASSIS)

PIN NO	U801 VOLTAGE	U802 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.5	6.8
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE: ALL VOLTAGES MAY VARY ±10% FROM NOMINAL READINGS SHOWN.

DEPS-21078-E

1. INTRODUCTION

This section contains specific theory of operation, maintenance, and troubleshooting information on the receiver rf and i-f deck.

2. RECEIVER RF AND IF DECK FUNCTIONAL DESCRIPTION

2.1 RF INJECTION STRING

2.1.1 Oscillator (Channel Element)

Channel elements are temperature compensated, crystal controlled oscillators (TCXO), operable over the temperature range of -30° to +60° C (-22° to +140° F). A variable warp capacitor, located in the base of the oscillator, is provided for increased accuracy. Channel elements are factory sealed plug-in modules and should not be field serviced.

2.1.2 Multipliers

The third harmonic of the channel element is selected by a two cell LC tuned circuit. The signal is then multiplied 16 times by two doubler circuits and a quadrupler circuit and applied to the two cell preselector of the first mixer.

2.2 RF PRESELECTOR

RF preselector selectivity prevents receiver degradation from mixer image frequency and spurious harmonics. It consists of five low loss, highly selective helical resonant cavities. The bandpass of the preselector is characterized by a flat acceptance bandwidth and a steep skirt response. Carrier signals received at the antenna are routed through the preselector cavities to the mixer stage to be heterodyned with the injection frequency.

2.3 FIRST MIXER

The first mixer heterodynes the rf signal from the injection string with the carrier signal from the preselector, producing a high i-f of 45 MHz. Frequency relationships are as follows:

$$fc = 48\ fo + 45\ MHz$$

Where fc = carrier frequency
fo = channel element fundamental

2.4 DOUBLE-POLE CRYSTAL FILTER

The double-pole crystal filter accepts the high i-f of 45 MHz and attenuates signals outside the bandwidth. It increases receiver selectivity and couples the high i-f to the second mixer.

2.5 SECOND MIXER

The second mixer uses a field effect transistor with low noise level and high conversion gain to heterodyne the high i-f with a second oscillator frequency, producing a low i-f of 11.7 MHz. Frequency relationships are expressed as follows:

$$45\ MHz = fo + 11.7\ MHz$$

Where fo = second oscillator frequency

2.6 SECOND OSCILLATOR AND BUFFER

The second oscillator is a crystal controlled, tunable oscillator. It employs a buffer output to prevent load variations from degrading the generated signal and filtering to reduce spurious harmonics.

2.7 FIRST FOUR-POLE CRYSTAL FILTER

This filter and the second four-pole crystal filter are the major factors determining final receiver bandwidth and selectivity.

The first four-pole crystal filter consists of two monolithic crystals and associated impedance matching circuitry. The output of the mixer is coupled to the input of the filter by an adjustable matching network.

Each crystal produces mechanical vibrations at the crystal input when the electrical i-f signal is applied. Due to the inherent piezoelectric property of quartz crystals, these vibrations are propagated throughout the crystal and reconverted to electrical signals at the output electrodes. The high "Q" of the crystals creates a narrow bandpass, resulting in excellent off-channel signal rejection.

2.8 FIRST IF AMPLIFIER

The first i-f amplifier couples signals between the first and second four-pole crystal filters and provides approximately 70 dB gain. The IC contains three differential amplifier stages that are internally voltage regulated and temperature compensated. Isolation between the three stages is provided internally.

2.9 SECOND FOUR-POLE CRYSTAL FILTER

The second four-pole crystal filter establishes final receiver selectivity and operates identically to the first four-pole crystal filter previously described. The filtered signal is applied to the second i-f amplifier.

2.10 SECOND IF AMPLIFIER AND LIMITER

The second i-f amplifier and limiter consists of an IC with associated discrete components and performs amplification and limiting functions.

Four differential amplifiers with internal voltage regulation and temperature compensation are employed. The first two differential amplifiers provide approximately 55 dB gain. The second stage output provides metering and is applied to the third stage. This third stage, along with the fourth stage, becomes overdriven to provide excellent symmetrical limiting characteristics. Full limiting occurs regardless of signal strength.

The limited output of the second i-f amplifier is applied to the discriminator. Since amplitude has now been made constant, the discriminator, which normally would respond to both amplitude and frequency variations, will produce true frequency demodulation.

3. MAINTENANCE

3.1 INTRODUCTION

This section provides maintenance procedures for the receiver rf and i-f board. These procedures consist of tests which include metering measurements and testing and troubleshooting procedures that include integrated circuit checks.

NOTE

The receiver rf and i-f board must be installed in a receiver chassis for testing to provide the necessary power, ground, control and signal connections. The board should always be secured in place with all mounting screws for operation and testing to provide a good rf ground to all stages of the receiver.

3.2 PERFORMANCE TESTS

3.2.1 General

Use the following tests to determine if the receiver rf and i-f board is operating properly. If testing produces unsatisfactory results, refer to the receiver rf and i-f troubleshooting chart (diagram PEPS-24796).

3.2.2 No-Signal Meter Reading Test

A failure in any part of the rf and i-f board will usually result in improper meter readings at one or more test positions. Perform checks at meter positions 1 through 5 and compare the results with values shown in Table 1.

Table 1. Minimum Receiver RF & IF Meter Readings
(No Input Signal Applied)

SELECTOR SWITCH POSITION	READING (MICRO-AMPS)	CIRCUIT METERED
1	10	Channel element output
2	15	First Doubler output
3	10	Second Doubler output
4+, 4-	0 ±2	Discriminator output
5	10	Second i-f amplifier and limiter

3.2.2.1 Using the Portable Test Set

Step 1. The receiver rf and i-f board must be installed in a complete receiver chassis for testing. Make sure the rf and i-f circuit board mounting screws are all secure and that all connections to the board are properly made.

Step 2. Be sure the receiver shield is in place.

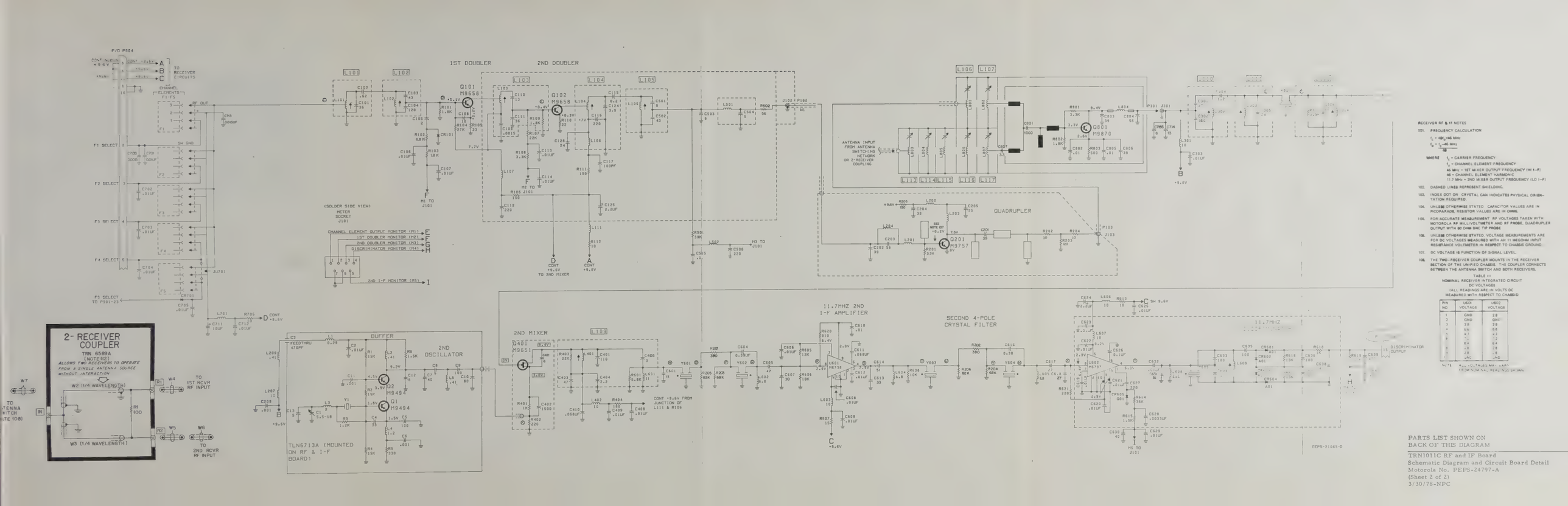
Step 3. Apply ac input power to the receiver.

Step 4. Using a TEK-37 Adapter Cable, connect a Motorola portable test set or meter panel to the receiver as follows:

--Connect the adapter cable 20-pin connector to the receptacle on the front of the test set or meter panel.

--Connect the adapter cable 7-pin white "metering" plug to the metering receptacle on the receiver rf and i-f board.

Step 5. Set the portable test set switches as follows:



RECEIVER RF & IF NOTES

101. FREQUENCY CALCULATION

$f_R = (8N_{HR} + 46)$ MHz

$f_R = (-46)$ MHz

$8N$

WHERE f_R = CARRIER FREQUENCY

f_E = CHANNEL ELEMENT FREQUENCY

46 MHz = 1ST MIXER OUTPUT FREQUENCY (MI I-F)

$8N$ = CHANNEL ELEMENT HARMONIC

11.7 MHz = 2ND MIXER OUTPUT FREQUENCY (LO I-F)

102. DASHED LINES REPRESENT SHIELDING.

103. INDEX DOT ON CRYSTAL CAN INDICATES PHYSICAL ORIENTATION REQUIRED.

104. UNLESS OTHERWISE STATED CAPACITOR VALUES ARE IN PICOFARADS, RESISTOR VALUES ARE IN OHMS.

105. FOR ACCURATE MEASUREMENT RF VOLTAGES TAKEN WITH MOTOROLA RF MILLIVOLTMETER AND RF PROBE, QUADRUPLER OUTPUT WITH 50 OHM BNC TIP PROBE.

106. UNLESS OTHERWISE STATED VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER IN RESPECT TO CHASSIS GROUND.

107. DC VOLTAGE IS FUNCTION OF SIGNAL LEVEL.

108. THE TWO-RECEIVER COUPLER MOUNTS IN THE RECEIVER SECTION OF THE UNIFIED CHASSIS. THE COUPLER CONNECTS BETWEEN THE ANTENNA SWITCH AND BOTH RECEIVERS.

TABLE III

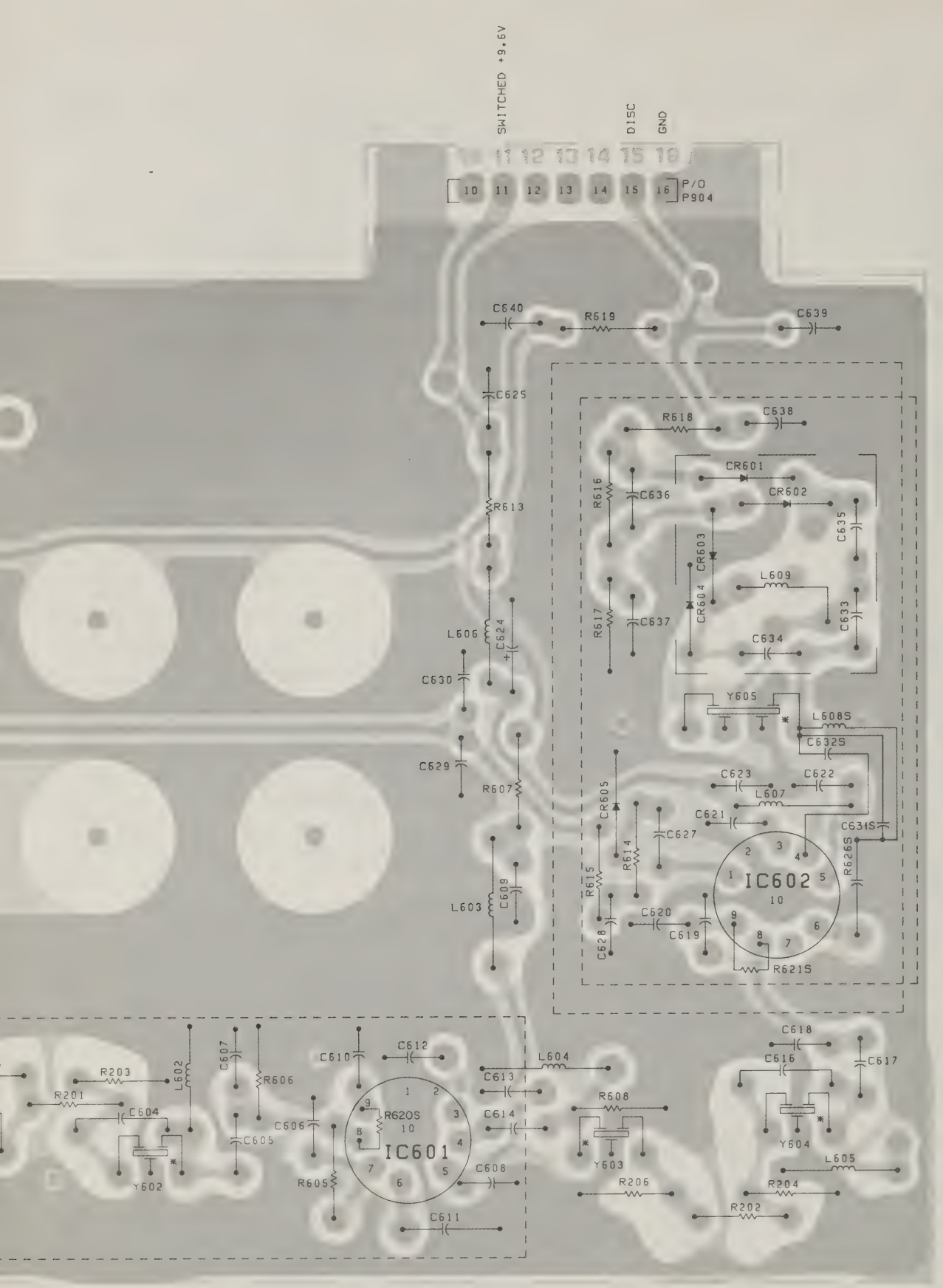
NOMINAL RECEIVER INTEGRATED CIRCUIT DC VOLTAGES

(ALL READINGS ARE IN VOLTS DC MEASURED WITH RESPECT TO CHASSIS)

PIN NO	U601 VOLTAGE	U602 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	4.1	4.2
6	2.7	2.7
7	6.4	6.4
8	2.8	2.8
9	2.8	8
10	GND	GND

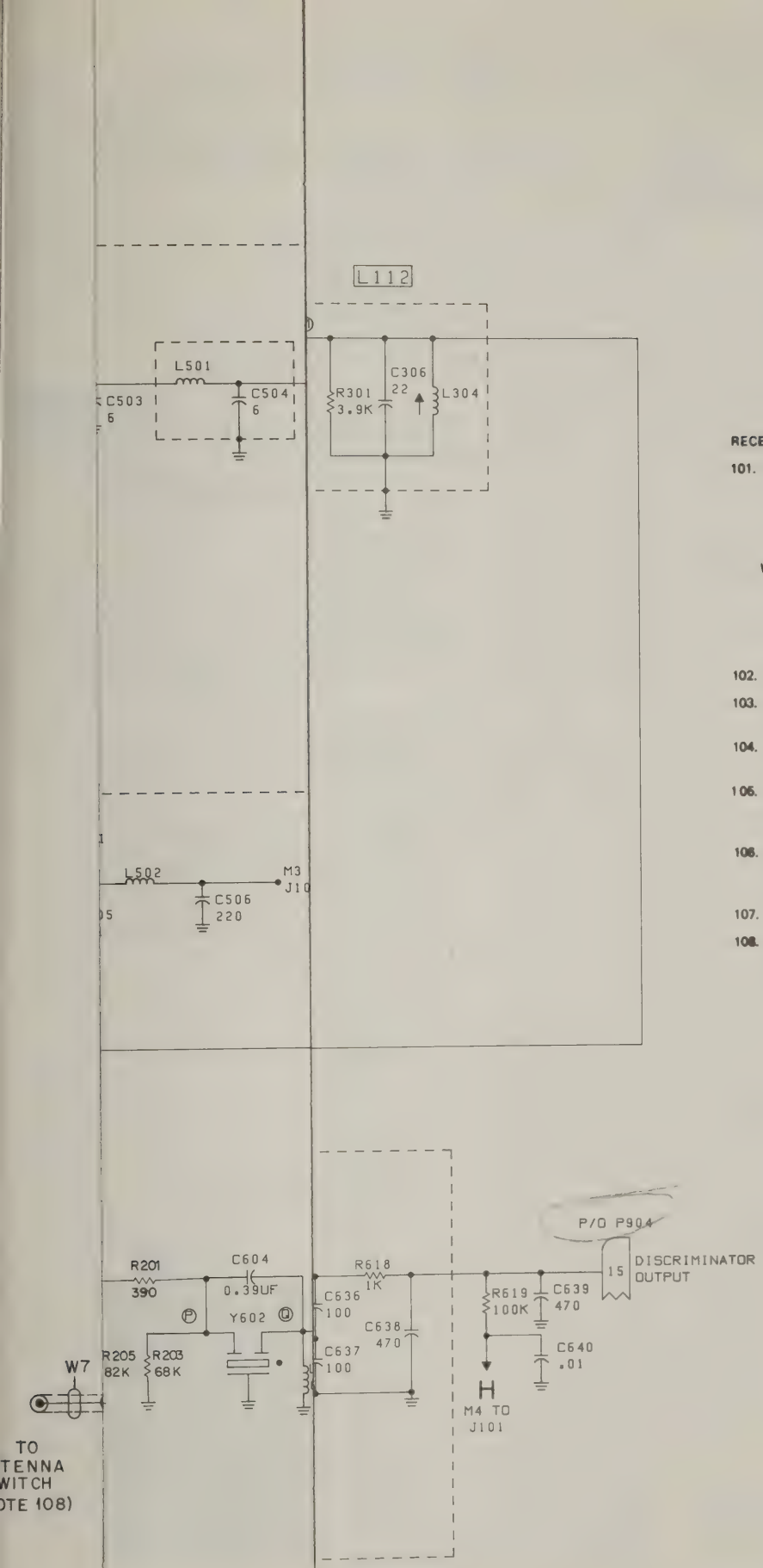
NOTE: ALL VOLTAGES MAY VARY FROM NOMINAL READINGS SHOWN.

EEPS-21065-O



SHIELD ON COMPONENT SIDE
SHIELD ON SOLDER SIDE
PARTS ENDING IN 'S' ARE ON SOLDER SIDE
*—INDICATES CRYSTAL POLARITY

COMPONENT SIDE BD-EEPS-24370-0
SOLDER SIDE BD-EEPS-24371-0
OL-EEPS-24372-0



RECEIVER RF & IF NOTES:

101. FREQUENCY CALCULATION:

$$f_c = 48f_o + 45 \text{ MHz}$$

$$f_o = \frac{f_c - 45 \text{ MHz}}{48}$$

WHERE: f_c = CARRIER FREQUENCY
f_o = CHANNEL ELEMENT FREQUENCY
45 MHz = 1ST MIXER OUTPUT FREQUENCY (HI I–F)
48 = CHANNEL ELEMENT HARMONIC
11.7 MHz = 2ND MIXER OUTPUT FREQUENCY (LO I–F)

102. DASHED LINES REPRESENT SHIELDING.

103. INDEX DOT ON CRYSTAL CAN INDICATES PHYSICAL ORIENTATION REQUIRED.

104. UNLESS OTHERWISE STATED: CAPACITOR VALUES ARE IN PICOFARADS, RESISTOR VALUES ARE IN OHMS.

105. FOR ACCURATE MEASUREMENT, RF VOLTAGES TAKEN WITH MOTOROLA RF MILLIVOLTMETER AND RF PROBE, QUADRUPLER OUTPUT WITH 50 OHM BNC TIP PROBE.

106. UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER IN RESPECT TO CHASSIS GROUND.

107. DC VOLTAGE IS FUNCTION OF SIGNAL LEVEL.

108. THE TWO–RECEIVER COUPLER MOUNTS IN THE RECEIVER SECTION OF THE UNIFIED CHASSIS. THE COUPLER CONNECTS BETWEEN THE ANTENNA SWITCH AND BOTH RECEIVERS.

TABLE III
NOMINAL RECEIVER INTEGRATED CIRCUIT
DC VOLTAGES
(ALL READINGS ARE IN VOLTS DC,
MEASURED WITH RESPECT TO CHASSIS)

PIN NO.	U601 VOLTAGE	U602 VOLTAGE
1	GND	2.8
2	GND	GND
3	2.8	2.8
4	6.6	6.6
5	9.3	9.3
6	7.2	7.2
7	6.4	6.4
8	2.8	2.8
9	2.8	2.8
10	GND	GND

NOTE: ALL VOLTAGES MAY VARY FROM NOMINAL READINGS SHOWN.

PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

TRN1011C RF and IF Board
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-24797-A
(Sheet 2 of 2)
3/30/78-NPC

PARTS LIST

TLF6011C Receiver RF and IF Board PL-5637-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF ±5%; 500 V, unless otherwise stated
C101	21-82355B63	3o
C102	21-82450B46	0.62
C103	21-82355B64	43
C104	21-82610C09	120; 200 V
C105	21-857336	2 a.2
C106,107	21-82428B59	.01 uF +80-20%; 200 V
C108	21-82355B26	10 ±.25
C109,C7135	21-82187B11	.0015 uF ±10%; 100 V
C110	21-82610C74	13
C111	21-82133G39	3o
C112	21-82187B08	220 ±10%
C113,114	21-82428B59	.01 uF +80-20%; 200 V
C115	21-82450B35	0.2 ±10%
C116	21-82187B08	220 ±10%
C117	21-833125	100 ±10%; 300 V
C124	21-82133G46	3.9 +-.25%
C125	21-84762H04	2.2 uF ±20%
C128	21-840365	24
C209	21-82187B20	1000 ±10%; 100 V
C301	21-83406D37	27
C302	21-84534B05	160
C303	21-82428B59	.01 uF +80-20%; 200 V
C304	21-82450B08	1.2
C305	21-82133G46	24
C306	21-82133G52	22
C401	21-82610C69	110, 200 V
C402	21-82187B31	1500 ±10%; 200 V
C403	21-82610C03	47; 200 V
C404	23-84762H04	2.2 uF ±20%; 25 V
C405	21-82450B13	3 -.5%; 500 V
C408, 409	21-82428B59	.01 uF +80-20%; 200 V
C410	8-82905G04	.068 uF ±10%; 50 V
C503,4315, 7155	21-840848	6 -.5%
C502	21-849321	43
C503,C504	21-840848	6
C505	21-82428B59	.01
C506	21-82187B08	220
C601	21-857345	11 -5%; NPO
C604	21-82450B07	0.39
C605	21-83406D44	47 +-5%; N080
C606	21-82428B59	.01 uF +80-20%; 200 V
C607	21-82610C14	30 -5%; N150
C608	21-82428B59	.01 uF +80-20%; 200 V
C609,610	21-82428B59	.01 uF +80-20%; 200 V
C611	8-83813H05	.068 uF ±10%; 100 V
C612	21-82428B59	.01 uF ±10%; 200 V
C613	21-82355B09	33 -5%; NPO
C614	21-82610C29	51 -5%; N150
C616	21-82450B01	0.30 -5%
C617,618	21-83406D37	27 -5%; N150
C619,620, 621,622,623	21-82428B59	.01 uF +80-20%; 200 V
C624	23-84762H04	2.2 uF ±20%; 25 V
C625	21-82428B59	.01 uF +80-20%; 200 V
C626	8-83813H06	.10 uF ±10%; 100 V
C627	21-82187B08	220
C628	21-82428B57	.0033 uF ±10%; 200 V
C629	21-82428B59	.01 uF +80-20%; 200 V
C630	21-84493B24	40
C631	21-82610C07	51; 200 V
C632	21-861443	.01 uF +100-20%; 75 V
C633, 634, 635,636,637	21-83798B01	100; 200 V
C638,639	21-82187B39	470 ±10%
C640	21-82428B59	.01 uF +80-20%; 200 V
C701 thru 705	21-82428B59	.01 uF +80-20%; 200 V
C711	23-84762H03	10 uF ±10%; 20 V
C712	21-82428B59	.01 uF +80-20%; 200 V
C714	21-00865054	13 -5%; N330
CR101	48-82139G01	DIODES: (SEE NOTE) germanium
CR601 thru 604	48-84616A01	hot carrier
CR605	48-82139G01	germanium
CR701	48-82392B03	silicon

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
J101	9-84207B01	CONNECTOR, receptacle: female; 7 contact
J102, J301	9-84231B02	female; single contact
		COIL, RF:
L101	24-84972A15	8-1/2 turns; (BRN)
L102	24-84972A16	6-1/2 turns; (RED)
L103	24-84972A17	8-1/2 turns; (ORG)
L104	24-83857G07	12 turns; (multiplier)
L105	24-83857G05	14-1/4 turns; (multiplier)
L106	24-83961B01	3 turns; (BRN)
L107, L111, L502	24-83961B01	3 turns; (BRN)
L207	24-82723H07	choke; 10 uH
L209	24-82723H05	choke; 0.41 uH: (YEL)
L301	24-82723H07	choke; 10 uH
L302 thru 304	24-84113B01	7-1/2 turns; (BRN)
L401	24-84258B05	green
L402	24-82723H07	choke, 10 uH
L403	24-82549D25	choke, 10 uH
L602	24-84250D02	choke, 6.8 uH
L603	24-82723H07	choke, 10 uH
L604,605	24-84250D02	choke, 6.8 uH
L606,607	24-82723H07	choke, 10 uH
L608	24-84250D03	choke, 2, 2 uH
L609	24-83879G04	20 turns (YEL)
L701	24-83961B01	3 turns; (BRN)
L501	24-83884G01	choke; molded
		TRANSISTOR: (SEE NOTE)
Q101,102	48-869658	NPN; M9658
Q401	48-869651	field-effect
		RESISTOR, fixed; ±10%; 1/4 W, unless otherwise stated
R101	6-124C55	1.8k
R102	6-124A69	6.8k -5%; 1/4 W
R103	6-124A55	1.8k -5%; 1/4 W
R104	6-124C83	27k
R105	6-124A13	33 ±5%
R106	6-124C29	150
R107	6-124C81	22k
R108	6-124C63	3.3k
R109	6-124C55	1.8k
R110	6-124A09	22 ±5%
R111	6-124C29	150
R112	6-124C01	10
R113	6-185B64	56 ±10%; 1/8 W
R201,202	6-124A39	390
R203,204	6-124A93	68k
R205,206	6-124A95	82k
R301	6-124A63	3.9k
R401	6-124C49	1k
R402	6-124A32	220 ±5%
R403	6-124A81	22k ±5%
R404	6-124C31	180
R501	6-124C87	39k
R502	6-185B64	56; 1.8 W
R601	6-124A69	6.8k ±5%
R605	6-124A75	12k ±5%
R606	6-124A73	10k ±5%
R607	6-124C05	15
R608	6-124A73	10k ±5%
R613	6-124C01	10
R614	6-124A85	36k ±5%
R615	6-124C53	1.5k
R616, 617	6-124A76	13k
R618	6-124C49	1k
R619	6-124A97	100k
R620	6-124A48	910 ±5%
R621	6-124A33	220 ±5%
R706	6-124C01	10
		INTEGRATED CIRCUIT: (SEE NOTE)
U601	51-84267A38	type M6738
U602	51-84267A07	type M6707
		CRYSTAL: (SEE NOTE)
Y602 thru 604	48-84755E07	11.7 MHz
Y605	48-84754E01	11.7 MHz (discriminator)
Y301	48-84577K01	45.0 MHz
Y601	48-84755E08	11.7 MHz

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NON-REFERENCED ITEMS
	3-134212	SCREW; 4-40 x 5/16"; 10 req'd.
	3-138162	SCREW; tapping; 4-40 x 3/8"; 8 req'd.
	3-138891	SCREW; tapping; 6-32 x 7/16"; 6 req'd.
	4-49854	Washer, spacer; 2 req'd.
	29-855943	PIN, terminal, plated; 20 req'd.
	29-10134A29	LUG, terminal
	29-84028H01	TERMINAL, male; 16 req'd.
	43-868700	BUSHING, threaded; 8 req'd.
	55-84300B02	HANDLE; 2, 12"
	55-84300B03	HANDLE; 1, 83"

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN6713A 2nd Oscillator Kit PL-4217-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
C1	20-82399D04	CAPACITOR, fixed: variable; 5, 5-18 pF
C2	21-82428B59	.01 uF +80-20%; 200 V
C3	21-821474	470 pF ±20%; 500 V
C4	21-82355B09	33 pF ±5%; 500 V
C5	21-833125	100 pF ±10%; 300 V
C6	21-82187B14	.001 uF ±10%; 100 V
C7	21-84395B01	40 pF ±5%; 500 V
C8	21-840848	6 pF +0.5 pF ; 500 V
C9	21-82610C44	100 pF ±10%; 100 V
C10	21-82880E33	80 pF ±5%; 500 V
C11	21-82187B14	.001 uF ±10%; 100 V
C12	21-840848	6 pF +0.5 pF; 500 V
C13	21-82204B22	5 pF ±5%; 250 V
		COIL, RF:
L1	24-82723H04	choke, 0.29 uH
L2	24-82723H05	choke, 0.41 uH
L3	24-890687	choke, 2.9 uH
L4	24-82723H01	choke, 1.2 uH
L5	24-82723H05	choke, 0.41 uH
		TRANSISTOR: (SEE NOTE)
Q1, 2	48-869494	NPN; type M9494
		RESISTOR, fixed:
R1, 2	6-124C77	15K ±10%; 1/4 W
R3	6-124C51	1.2K ±10%; 1/4 W
R4	6-124C77	15K ±10%; 1/4 W
R5	6-124A37	330 ±5%; 1/4 W
R6	6-124A53	1.5K ±5%; 1/4 W
Y1	48 83860F09	CRYSTAL: 33.3 MHz
		MECHANICAL PARTS
	3-139012	SCREW, 4-40 x 1/4"
	4-474216	WASHER, 2 req'd.
	15-82304L01	COVER
	43-83066F05	BUSHING, .250" length; 2 req'd.
	43-83066F06	BUSHING, .170" length
	43-83617D01	BUSHING, round
	14-84602K02	INSULATOR, crystal; 2 req'd.
	26-82303L01	SHIELD
	43-82555L01	SPACER, threaded (oscillator shield)

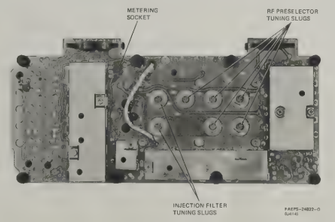
NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part number.

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
TRN6773A 2 Receiver Hardware Kit		PL-4433-O
	2-101A53	NUT, spring
	2-82365B07	NUT, speed
	3-135038	SCREW, tapping; #14-14 x 3/4"
	26-83820K01	SHIELD and INSERT, receiver
	26-84643E01	SHIELD, pc board
	26-84981F01	SHIELD, receiver
	46-84090C01	STUD, retainer
	55-84300B01	HANDLE

TRF6021A RF Deck PL-5638-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed:
C801	21-84547A01	1000 -20%; 50 V
C802	21-84547A05	10000 pF ±20%; 50 V
C803	21-84736E12	39 pF ±5%; 500 V
C804	21-84873H17	56 pF ±10%; 50 V
C805	21-84547A05	10000 pF ±20%; 50 V
C806	21-84736E12	39 pF ±5%; 500 V
C807	21-84736E27	3.3 pF -.25%
J102	8-82547L02	CONNECTOR, receptacle: FEMALE, single contact
		COIL, RF:
L801 thru 807	ID83010K03	RESONATOR and LEAD ASSY.
L808	76-83960B01	FERRITE BEAD
L809	24-82723H05	choke; 0.41 uH
L810	26-83960B01	FERRITE BEAD
P301	28-84282D01	CONNECTOR, plug: male; single contact
P102	28-87317C01	male, single contact
Q801	48-869870	TRANSISTOR: (SEE NOTE) NPN; M9870
R801,802,803		Cannot be replaced
		MECHANICAL PARTS
	3-134268	SCREW, tapping: 4-40 x 7/16" 4 req'd.
	15-84630E01	COVER, connector (J801)
	42-83032K01	HOLDER: 2 req'd.
	64-83018K02	PLATE, cover
	29-5227	LUG, soldering #6; 2 req'd.
	15-830143K01	HOUSING, rf deck
	2-84773E03	NUT, tension: 7 req'd.
	3-84997K01	SLUG TUNING; 7 req'd.
	32-82101L02	GASKET
	3-136138	SCREW, tapping: 6-32 x 3/8"; 11 req'd.

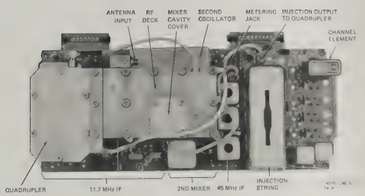
NOTE:
For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.

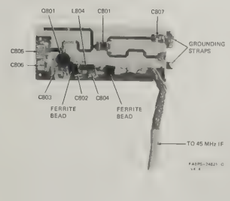


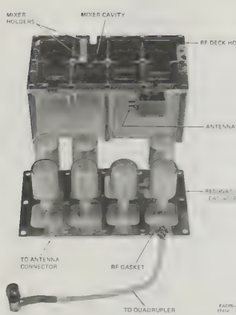
TLF6163A Quadrupler PL-5639-A

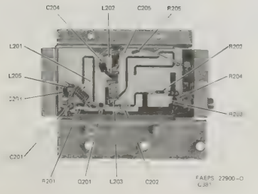
REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITORS fixed, pF, ±5% 50 V; unless otherwise stated
C201	21-84736E12	39
C202	21-84736E12	39
C203	21-84873H17	56; ±10%
C204	21-84736E12	39
C205	21-84736E10	25
		COILS:
L201	24-83884G04	6-1/2 turns: (yellow)
L202	24-82723H04	choke; 290 uH
L203	24-83884G01	3-1/2 turns (pink)
L205	24-82723H04	choke; 290 uH
Q201	48-869970	TRANSISTORS: (SEE NOTE) NPN; type M9970
		RESISTORS: fixed, 10%, 1/8 W
R201	6-185A61	3.3k ±5%
R202	6-185B55	10
R203	6-185B68	120
R204	6-185B55	10
R205	6-185A29	150 ±5%
		NON-REFERENCED ITEMS
	1-80791B63	CABLE, quadrupler includes
	29-5227	LUG, solder; 2 req'd.
	28-84282D01	CONNECTOR, phono
	30-83794C01	CABLE
	1-80791B64	CHASSIS includes
	3-134169	SCREW; 4-40 x 1/4; 6 req'd.
	10-83170H01	RING, solder
	64-82576L01	COVER
	15-82575L01	CHASSIS
	91-87511C01	RFI FILTER FEEDTHRU
	9-82547L02	RECEPTACLE, mini, coaxial
	39-10184A24	CONTACT, bubble-pin; chain-form

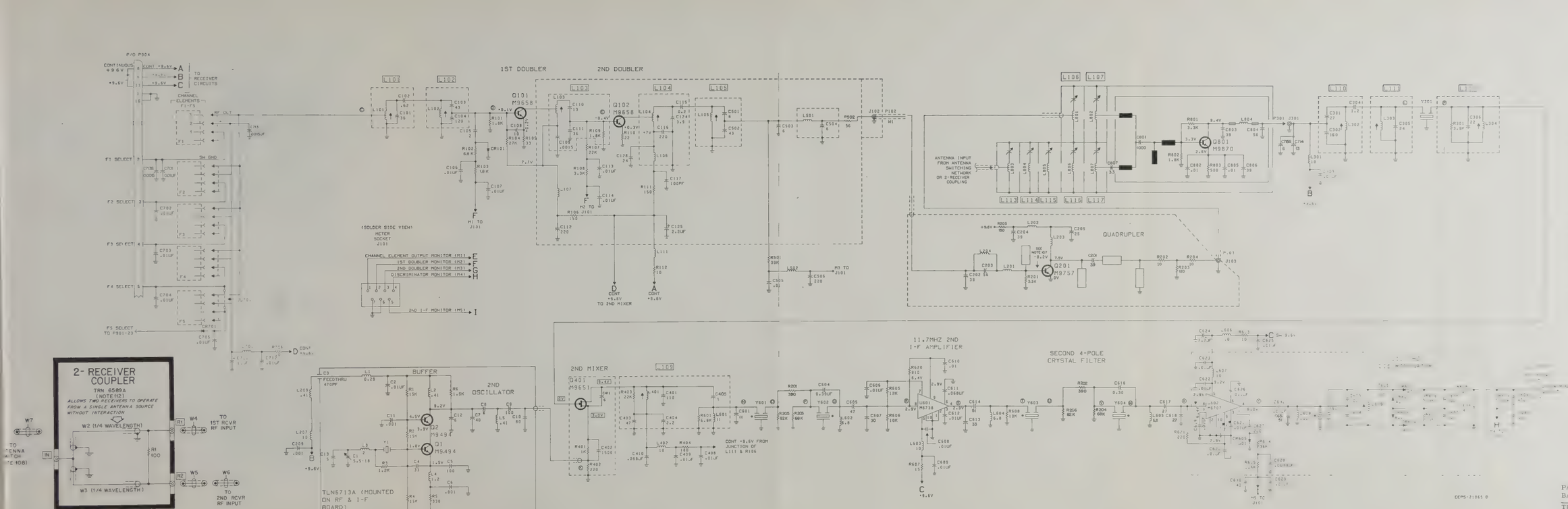
NOTE:
For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.

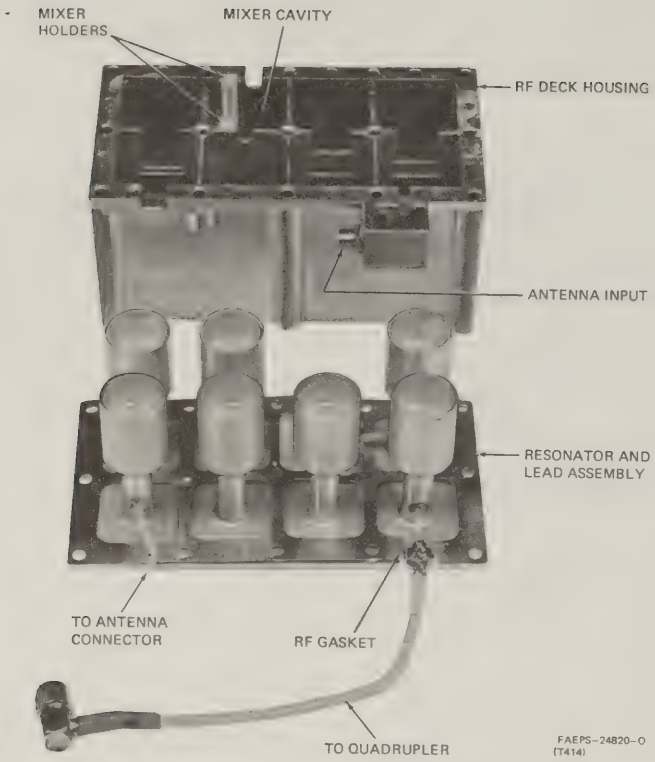


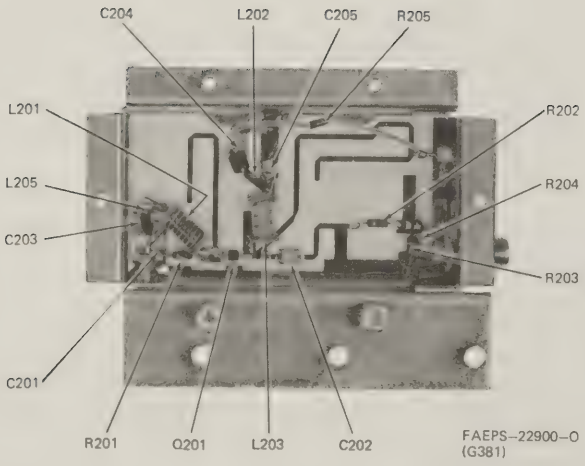







1ST DOUBLER
2ND DOUBLER
2- RECEIVER COUPLER
TRN 6589A
(NOTE 112)
ALLOWS TWO RECEIVERS TO OPERATE FROM A SINGLE ANTENNA SOURCE WITHOUT INTERACTION
W2 (1/4 WAVELENGTH)
W3 (1/4 WAVELENGTH)
TO 1ST RCVR RF INPUT
TO 2ND RCVR RF INPUT
BUFFER
2ND OSCILLATOR
2ND MIXER
11.7MHZ 2ND I-F AMPLIFIER
SECOND 4-POLE CRYSTAL FILTER
QUADRUPLER
TLN5713A (MOUNTED ON RF & I-F BOARD)
(SOLDER SIDE VIEW) METER SOCKET J101
CHANNEL ELEMENT OUTPUT MONITOR (M1)
1ST DOUBLER MONITOR (M2)
2ND DOUBLER MONITOR (M3)
DISCRIMINATOR MONITOR (M4)
2ND I-F MONITOR (M5)
ANTENNA INPUT FROM ANTENNA SWITCHING NETWORK OR 2-RECEIVER COUPLING
TO RECEIVER CIRCUITS
CHANNEL ELEMENTS F1-F5
RF OUT
F1 SELECT
F2 SELECT
F3 SELECT
F4 SELECT
F5 SELECT
TO P801-23
CONTINUOUS +9.6V
CONT +8.6V
+8.6V
SW GND
CONT +8.6V TO 2ND MIXER
CONT +8.6V FROM JUNCTION OF L111 & R106
M1 TO J101
M2 TO J101
M3 TO J101
P.O. P304
P.O. P302
P.O. P303
P.O. P301
J102 J103 J104 M1
J101 J102 J103 J104 M2
J101 J102 J103 J104 M3
J101 J102 J103 J104 M4
J101 J102 J103 J104 M5
Q101 M9658
Q102 M9658
Q401 M9651
Q201 M9757
Q1 M9494
Q2 M9494
Q801 M9870
U401 M8738
U801 M8738
CR801 1000
CR802 3.3
CR803 3.3K
CR804 1.8K
CR805 3.3K
CR806 2.6V
CR807 2.6V
CR808 2.6V
CR809 2.6V
CR810 2.6V
CR811 2.6V
CR812 2.6V
CR813 2.6V
CR814 2.6V
CR815 2.6V
CR816 2.6V
CR817 2.6V
CR818 2.6V
CR819 2.6V
CR820 2.6V
CR821 2.6V
CR822 2.6V
CR823 2.6V
CR824 2.6V
CR825 2.6V


MIXER HOLDERS
MIXER CAVITY
RF DECK HOUSING
ANTENNA INPUT
RESONATOR AND LEAD ASSEMBLY
TO ANTENNA CONNECTOR
RF GASKET
TO QUADRUPLER
FAEPS-24820-O (T414)


C204
L202
C205
R205
L201
R202
L205
R204
C203
R203
C201
R201
Q201
L203
C202
FAEPS-22900-O (G381)

"MICOR" "SENSITRON" RECEIVER AUDIO & SQUELCH BOARD

MODEL TRN8406A

1. DESCRIPTION

1.1 The audio and squelch board performs two basic functions -- audio amplification and audio squelching. The first two stages in the audio circuitry amplify the signal from the discriminator and provide the proper frequency response. This signal is routed to the line driver module in remote control stations and to the local logic board in local control models. The audio returns through a VOLUME control. The remaining stages in the audio circuitry take the signal returning from the line driver and VOLUME control and provide the necessary frequency response at the speaker. These latter stages also provide the driver required by the final audio amplifiers (located on a separate board) for rated power output. An integrated circuit and one transistor perform all of the above functions.

1.2 The squelch circuitry disables the audio path during intervals between received messages. One integrated circuit performs the necessary detection and squelching functions. Also, in conjunction with the PL decoder and filter board in a PL station, this integrated circuit provides unsquelching when PL signals are received.

2. FUNCTIONAL OPERATION

2.1 GENERAL

2.1.1 The audio signal from the receiver discriminator is routed to the emitter follower (refer to Figure 1.). The emitter follower output is coupled to the SQUELCH control mounted on the receiver chassis or local front panel and also to the line level potentiometer mounted on the audio & squelch board. The signal from this control is next applied to the preamplifier. If JU201 is cut, the signal is first sent through the PL filter for attenuation of the PL tone. The preamplifier output is coupled off the board to the line driver or local-logic board. Audio returning from the line driver or local-logic board is coupled through the appropriate VOLUME control to amplifier Q203. After amplification, the signal is applied to the audio amplification circuits. Here, the signal is raised to a level sufficient to drive the audio final amplifier. These are mounted on a separate board which is secured to the chassis to provide "heat-sinking" capability. The output of the audio power amplifiers is applied to an output transformer which drives a speaker or speaker desk-set transformer (local control stations only).

2.1.2 The signal returned from the SQUELCH control is applied to the squelch section for noise squelch control. Squelch action is achieved by utilizing the inherent characteristic of a discriminator known as noise quieting. An input signal will cause more quieting of noise as the signal level is increased. When a desired level of noise quieting is reached, as determined by the squelch circuitry and the setting of the SQUELCH control, the audio portion of the board and line driver are enabled to allow a message to be heard. In a remote control station, the squelch circuit disables the audio circuitry by shunting a point in the audio signal path to ground and also operating a series switch in the audio signal path of the line driver.

2.1.3 In a local control station, the series path is broken on the local-logic board. In addition, an extra shunt switch is activated on this board and its low resistance is directed back to the audio amplification circuits. This provides extremely quiet operation during periods of no signal.

MOTOROLA INC.
Communications Division

service publications
1301 E. Algonquin Road, Schaumburg, IL 60196

PARTS LIST

TLF6011C Receiver RF and IF Board — PL-5637-A

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed: pF ±5%; 500 V; unless otherwise stated
C101	21-82555B63	36
C102	21-82459B46	0.62
C103	21-82555B64	43
C104	21-82610C09	120; 200 V
C105	21-8573B6	2 ±.2
C106,107	21-82428B59	.01 uF +80-20%; 200 V
C108	21-82555B26	10 ±.25
C109,C7135	21-82187B11	.0015 uF ±10%; 100 V
C110	21-82610C74	13
C111	21-82703G36	36
C112	21-82187B08	220 ±10%
C113,114	21-82428B59	.01 uF +80-20%; 200 V
C115	21-82450B35	0.2 ±10%
C116	21-82187B08	220 ±10%
C117	21-8311I5	100 ±10%; 300 V
C124	21-82133G46	1.5 +-.25%
C125	23-84762H04	2.2 uF ±20%
C128	21-840365	24
C209	21-82187B10	1000 ±10%; 100 V
C301	21-83406D37	27
C302	21-84534B05	160
C303	21-82428B59	.01 uF +80-20%; 200 V
C304	21-82450B08	1.2
C305	21-82133G46	24
C306	21-82133G42	22
C401	21-82610C69	130; 200 V
C402	21-82187B31	1500 ±10%; 200 V
C403	21-82610C03	47; 200 V
C404	23-84762H04	2.2 uF ±20%; 25 V
C405	21-82450B11	3 -5%; 500 V
C406, 407	21-82428B59	.01 uF +80-20%; 200 V
C408	8-82905C04	.068 uF ±10%; 50 V
C501,511S, 715S	21-840848	6 -5%
C502	21-8493211	43
C503,C504	21-840848	6
C505	21-82428B59	.01
C506	21-82187B08	220
C601	21-851845	11 -5%; NPO
C604	21-82450B07	0.39
C605	21-83406D44	47 -5%; N080
C606	21-82428B59	.01 uF +80-20%; 200 V
C607	21-82610C14	30 -5%; N150
C679	21-82428B59	.01 uF +80-20%; 200 V
C605,606	21-82428B59	.01 uF +80-20%; 200 V
C611	8-838131105	.068 uF ±10%; 100 V
C612	21-82428B59	.01 uF ±10%; 200 V
C613	21-82355B09	33 -5%; NPO
C614	21-82610C29	51 -5%; N150
C615	21-82450B01	0.30 -5%
C617,618	21-83406D37	27 -5%; N150
C619,620, 621,622,623	21-82428B59	.01 uF +80-20%; 200 V
C624	23-84762H04	2.2 uF ±20%; 25 V
C625	21-82428B59	.01 uF +80-20%; 200 V
C626	8-838133D05	.10 uF ±10%; 100 V
C627	21-82187B08	220
C628	21-82428B57	.0033 uF ±10%; 200 V
C629	21-82428B59	.01 uF +80-20%; 200 V
C630	21-84493B24	40
C631	21-82610C07	51; 200 V
C632	21-8614I3	.01 uF +100-20%; 75 V
C633,634, 635,636,637	21-83798B01	100; 200 V
C638,639	21-82187B39	470 ±10%
C640	21-82428B59	.01 uF +80-20%; 200 V
C701thru 705	21-82428B59	.01 uF +80-20%; 200 V
C711	23-84762H03	10 uF ±10%; 20 V
C712	21-82428B59	.01 uF +80-20%; 200 V
C714	21-80865054	13 -5%; N330
		DIODES: (SEE NOTE)
CR101	48-8Z139G01	germanium
CR601 thru 604	48-84616A01	hot carrier
CR615	48-8Z139G01	germanium
CR701	48-82392B03	silicon

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CONNECTOR, receptacle:
J101	9-84207B01	female; 7 contact
J102, J301	9-84231B02	female; single contact
		COIL, RF:
L101	24-84972A15	8-1/2 turns; (BRN)
L102	24-84972A16	6-1/2 turns, (RED)
L103	24-84972A17	8-1/2 turns; (ORG)
L104	24-83857G07	12 turns; (multiplier)
L105	24-83857G05	14-1/4 turns; (multiplier)
L106	24-83961B01	3 turns; (BRN)
L107, L111,	24-83961B03	3 turns; (BRN)
L502		
L207	24-82723H07	choke; 10 uH
L209	24-82723H05	choke; 0.41 uH; (YEL)
L301	24-82723H07	choke; 10 uH
L302 thru 304	24-84113B01	7-1/2 turns; (BRN)
L401	24-84258B05	green
L402	24-82723H07	choke, 10 uH
L601	24-82545D25	choke, 10 uH
L602	24-84250D02	choke, 6.8 uH
L603	24-82723H07	choke, 10 uH
L604, 605	24-84250D02	choke, 6.8 uH
L606, 607	24-82723H07	choke, 10 uH
L608	24-84250D03	choke, 2.2 uH
L609	24-83879G04	20 turns (YEL)
L701	24-83961B01	3 turns; (BRN)
L501	24-83884G01	choke; molded
		TRANSISTOR: (SEE NOTE)
Q101,102	48-869658	NPN; M9858
Q401	48-869651	field-effect
		RESISTOR, fixed; ±10%; 1/4 W; unless otherwise stated
R101	6-124C55	1.8k
R102	6-124A69	6.8k -5%; 1/4 W
R103	6-124A55	1.8k -5%; 1/4 W
R104	6-124C83	27k
R105	6-124A13	33 ±5%
R106	6-124C29	150
R107	6-124C81	22k
R108	6-124C61	3.3k
R109	6-124C55	1.8k
R110	6-124A09	22 ±5%
R111	6-124C29	150
R112	6-124C01	10
R113	6-185B64	56 ±10%; 1/8 W
R201,202	6-124A39	390
R203,204	6-124A93	68k
R205,206	6-124A95	82k
R301	6-124A63	3.9k
R401	6-124C49	1k
R402	6-124A32	220 ±5%
R403	6-124A81	22k ±5%
R404	6-124C31	180
R501	6-124C87	39k
R502	6-185B64	56; 1/8 W
R601	6-124A69	6.8k ±5%
R605	6-124A75	12k ±5%
R606	6-124A73	10k ±5%
R607	6-124C05	15
R608	6-124A73	10k ±5%
R613	6-124C01	10
R614	6-124A86	36k ±5%
R615	6-124C53	1.5k
R616,617	6-124A76	13k
R618	6-124C49	1k
R619	6-124A97	100k
R620	6-124A48	910 ±5%
R621	6-124A33	220 ±5%
R706	6-124C01	10
		INTEGRATED CIRCUIT: (SEE NOTE)
U601	51-84267A38	type M6738
U602	51-84267A07	type M6707
		CRYSTAL: (SEE NOTE)
Y602 thru 604	48-84755E07	11.7 MHz
Y605	48-84754E01	11.7 MHz (discriminator)
Y301	48-84577K01	45.0 MHz
Y601	48-84755E08	11.7 MHz

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		NON-REFERENCED ITEMS
	3-134212	SCREW; 4-40 x 5/16"; 10 req'd,
	3-138162	SCREW; tapping; 4-40 x 3/8"; 8 req'd,
	3-138891	SCREW; tapping; 6-32 x 7/16"; 6 req'd,
	4-49854	Washer, spacer; 2 req'd,
	29-855943	PIN, terminal, plated; 20 req'd,
	29-10134A29	LUG, terminal
	29-84028H01	TERMINAL, male; 16 req'd,
	43-868700	BUSHING, threaded; 8 req'd,
	55-84300B02	HANDLE; 2, 12"
	55-84300B03	HANDLE; 1, 83"

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part numbers.

TRN6713A 2nd Oscillator Kit — PL-6217-O

C1	20-82399D04	CAPACITOR, fixed: variable; 5.5-18 pF
C2	21-82428B59	.01 uF +80-20%; 200 V
C3	21-821474	470 pF ±20%; 500 V
C4	21-82355B09	33 pF ±5%; 500 V
C5	21-8311I5	100 pF ±10%; 300 V
C6	21-82187B14	.001 uF ±10%; 100 V
C7	21-84395B01	40 pF ±5%; 500 V
C8	21-840848	6 pF ±0.5 pF ; 500 V
C9	21-82610C44	100 pF ±10%; 100 V
C10	21-82880E33	80 pF ±5%; 800 V
C11	21-82187B14	.001 uF ±10%; 100 V
C12	21-840848	6 pF ±0.5 pF; 500 V
C13	21-82204B22	5 pF ±5%; 250 V
		COIL, RF:
L1	24-82723H04	choke, 0.29 uH
L2	24-82723H05	choke, 0.41 uH
L3	24-890687	choke, 2.0 uH
L4	24-82723H01	choke, 1.2 uH
L5	24-82723H05	choke, 0.41 uH
		TRANSISTOR: (SEE NOTE)
Q1, 2	48-869494	NPN; type M9494
		RESISTOR, fixed:
R1, 2	6-124C77	15K ±10%; 1/4 W
R3	6-124C51	1.2K ±10%; 1/4 W
R4	6-124C77	15K ±10%; 1/4 W
R5	6-124A37	330 ±5%; 1/4 W
R6	6-124A53	1.5K ±5%; 1/4 W
		CRYSTAL:
Y1	48 83860F09	33.3 MHz

MECHANICAL PARTS

	3-139012	SCREW, 4-40 x 1/4"
	4-476216	WASHER, 2 req'd,
	15-82304L01	COVER
	43-83066F05	BUSHING, .250" length; 2 req'd,
	43-83066F06	BUSHING, .170" length
	43-83617D01	BUSHING, round
	14-84602X02	INSULATOR, crystal; 2 req'd,
	26-82303L01	SHIELD
	43-82555L01	SPACER, threaded (oscillator shield)

NOTE: For optimum performance, diodes, transistors, and integrated circuits must be ordered by Motorola part number.

TRN6673A 2 Receiver Hardware Kit — PL-4433-O

	2-101A53	NUT, spring
	2-82363B07	NUT, speed
	3-135038	SCREW, tapping; #14-14 x 3/4"
	26-83820K01	SHIELD and INSERT, receiver
	26-84043E01	SHIELD, pc board
	26-84981F01	SHIELD, receiver
	46-84090C01	STUD, retainer
	55-84300B01	HANDLE

TRF5021A RF Deck — PL-5638-O

C801	21-84547A01	CAPACITOR, fixed: 1000 -20%; 50 V
C802	21-84547A05	10000 pF ±20%; 50 V
C803	21-84736E12	39 pF ±5%; 500 V
C804	21-84873H17	56 pF ±10%; 50 V
C805	21-84547A05	10000 pF ±20%; 50 V
C806	21-84736E12	39 pF ±5%; 500 V
C807	21-84736E27	3.3 pF -.25%
J102	8-82547L02	CONNECTOR, receptacle: FEMALE, single contact
L801 thru 807	1D83010K03	COIL, RF: RESONATOR and LEAD ASSY.
L808	76-83960B01	FERRITE BEAD
L809	24-82723H05	choke; 0.41 uH
L810	26-83960H01	FERRITE BEAD
P301	28-84282D01	CONNECTOR, plug: male; single contact
P102	28-87317C01	male, single contact
Q801	48-869870	TRANSISTOR: (SEE NOTE) NPN; M9870
R801,802,803		Cannot be replaced

MECHANICAL PARTS

	3-134268	SCREW, tapping; 4-40 x 7/16" 4 req'd,
	15-84630E01	COVER, connector (J801)
	42-83032K01	HOLDER; 2 req'd,
	64-83018K02	PLATE, cover
	29-5227	LUG, soldering #6; 2 req'd,
	15-83014K01	HOUSING, rf deck
	2-84773E03	NUT, tension; 2 req'd,
	3-84997K01	SLUG TUNING; 7 req'd,
	32-82101L02	GASKET
	3-136138	SCREW, tapping; 6-32 x 3/8"; 11 req'd,

NOTE:
For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.

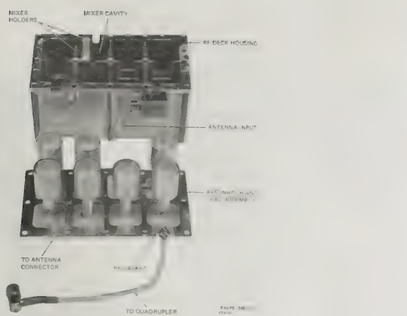
TLF6163A Quadrupler — PL-5639-A

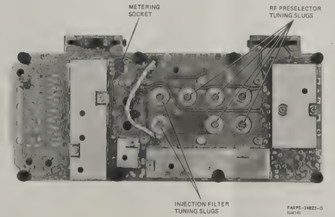
		CAPACITORS fixed, pF, ±5% 50 V, unless otherwise stated
C201	21-84736E12	39
C202	21-84736E12	39
C203	21-84873H17	56; ±10%
C204	21-84736E12	39
C205	21-84736E10	25
		COILS:
L201	24-83884G04	6-1/2 turns; (yellow)
L202	24-82723H04	choke; 290 uH
L203	24-83884C01	3-1/2 turns (pink)
L205	24-82723H04	choke; 290 uH
Q201	48-869970	TRANSISTORS: (SEE NOTE) NPN; type M9970
R201	6-185A61	RESISTORS: fixed, 10%, 1/8 W 3.3k ±5%
R202	6-185B55	10
R203	6-185B68	120
R204	6-185B55	10
R205	6-185A29	150 ±5%

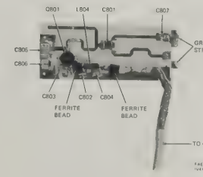
NON-REFERENCED ITEMS

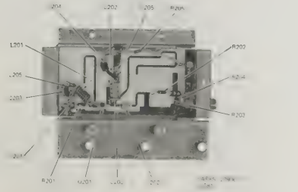
	1-80791B63	CABLE, quadrupler includes
	29-5227	LUG, solder; 2 req'd,
	28-84282D01	CONNECTOR, phono
	30-83794C01	CABLE
	1-80791B64	CHASSIS includes
	3-136169	SCREW; 4-40 x 1/4; 6 req'd,
	10-83170H01	RING, solder
	64-82576L01	COVER
	15-82575L01	CHASSIS
	91-87511C01	RFI FILTER FEEDTHRU
	9-82547L02	RECEPTACLE, mini. coaxial
	39-10184A24	CONTACT, bubble-pin; chain-form

NOTE:
For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.









"MICOR" "SENSITRON" RECEIVER AUDIO & SQUELCH BOARD

MODEL TRN8406A

1. DESCRIPTION

1.1 The audio and squelch board performs two basic functions -- audio amplification and audio squelching. The first two stages in the audio circuitry amplify the signal from the discriminator and provide the proper frequency response. This signal is routed to the line driver module in remote control stations and to the local logic board in local control models. The audio returns through a VOLUME control. The remaining stages in the audio circuitry take the signal returning from the line driver and VOLUME control and provide the necessary frequency response at the speaker. These latter stages also provide the driver required by the final audio amplifiers (located on a separate board) for rated power output. An integrated circuit and one transistor perform all of the above functions.

1.2 The squelch circuitry disables the audio path during intervals between received messages. One integrated circuit performs the necessary detection and squelching functions. Also, in conjunction with the PL decoder and filter board in a PL station, this integrated circuit provides unsquelching when PL signals are received.

2. FUNCTIONAL OPERATION

2.1 GENERAL

2.1.1 The audio signal from the receiver discriminator is routed to the emitter follower (refer to Figure 1.). The emitter follower output is coupled to the SQUELCH control mounted on the receiver chassis or local front panel and also to the line level potentiometer mounted on the audio & squelch board. The signal from this control is next applied to the preamplifier. If JU201 is cut, the signal is first sent through the PL filter for attenuation of the PL tone. The preamplifier output is coupled off the board to the line driver or local-logic board. Audio returning from the line driver or local-logic board is coupled through the appropriate VOLUME control to amplifier Q203. After amplification, the signal is applied to the audio amplification circuits. Here, the signal is raised to a level sufficient to drive the audio final amplifier. These are mounted on a separate board which is secured to the chassis to provide "heat-sinking" capability. The output of the audio power amplifiers is applied to an output transformer which drives a speaker or speaker desk-set transformer (local control stations only).

2.1.2 The signal returned from the SQUELCH control is applied to the squelch section for noise squelch control. Squelch action is achieved by utilizing the inherent characteristic of a discriminator known as noise quieting. An input signal will cause more quieting of noise as the signal level is increased. When a desired level of noise quieting is reached, as determined by the squelch circuitry and the setting of the SQUELCH control, the audio portion of the board and line driver are enabled to allow a message to be heard. In a remote control station, the squelch circuit disables the audio circuitry by shunting a point in the audio signal path to ground and also operating a series switch in the audio signal path of the line driver.

2.1.3 In a local control station, the series path is broken on the local-logic board. In addition, an extra shunt switch is activated on this board and its low resistance is directed back to the audio amplification circuits. This provides extremely quiet operation during periods of no signal.

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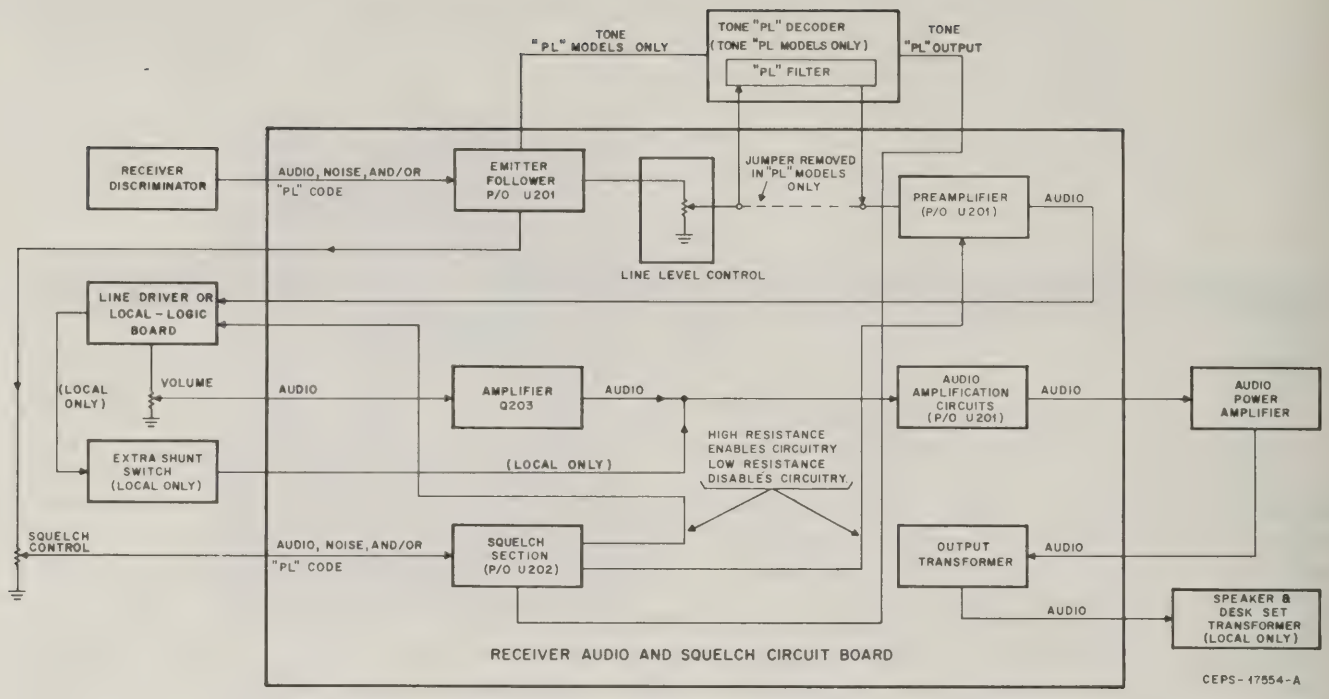


Figure 1.
Audio and Squelch Block Diagram

2.1.4 Upon completion of a received message, audio shut-off is either immediate or automatically delayed 150 milliseconds, depending upon the signal level of the previously received rf carrier. A strong signal produces the immediate shut-off and prevents an annoying, loud "squelch tail" burst from being heard. Weak signals (signals that produce less than 20 dB noise quieting) produce the long shut-off delay and prevent a message from being chopped under "flutter" conditions. Since the received signal level must be low for the long turn-off delay to occur and the "squelch tail" level is comparable to that of the received signal, the "squelch tail" is not annoying.

2.2 EMITTER FOLLOWER CIRCUIT

2.2.1 The emitter follower circuit provides a low impedance output which isolates the high impedance discriminator output from the following squelch and audio circuitry.

2.2.2 The output of the discriminator is capacitively coupled to the emitter follower input at U201-1 and may consist of noise and audio signals. The output of the emitter follower at U201-2 is routed through C207 to the SQUELCH control.

2.3 PREAMPLIFIER CIRCUIT

This circuit amplifies the low-level audio signal to provide the drive necessary for proper line driver operation. In addition, a negative feedback network (C208 and C209) provides the necessary frequency response characteristics for phone line operation. In PL stations, jumper JU202 is cut and the negative feedback is provided by C209 only. The network of R210 and C210 provides additional frequency response shaping.

2.4 AMPLIFIER CIRCUIT

Transistor Q203 increase the signal level from the line driver or local-logic board to the level required by the audio amplification circuits. Jumper JU203 is out when the equipment leaves the factory. The gain of Q203 is sufficient to drive the audio amplification circuits if the signal strength from the line driver or squelch gate exceeds -10 dBm. With a signal strength below this level, it is advisable to put in JU203 which increases the gain of Q203. The RC network at the input to this stage provides additional frequency response shaping required at the speaker.

2.5 AUDIO AMPLIFICATION CIRCUIT

2.5.1 The signal from amplifier Q203 is applied to the differential amplifier through capacitors C211 and C213. In a local station, the extra shunt switch on the local-logic board is connected to the junction of C211 and C213.

2.5.2 The differential amplifier output provides the drive for the complementary amplifier. Resistors R221 and R220 form a voltage divider biasing the differential amplifier at one-half of the supply voltage. Undesirable transient voltages are eliminated by capacitor C212.

2.5.3 Final audio amplification on the audio and squelch board occurs in the complementary amplifier. These stages provide the drive for the audio power amplifiers which are mounted on a separate board. The complementary amplifier emitter resistors (R218 and R219) are not included in U201 because of their high heat dissipation requirements.

2.5.4 Audio returned to the audio and squelch board (from the audio power amplifier transistors) is applied to the output transformer primary windings. This transformer consists of four windings -- two input primaries, an output secondary, and a feedback secondary. The output secondary winding couples audio power to an external 8-ohm speaker which can be driven with up to 10 watts at less than 5% distortion. Negative feedback from the output transformer winding through C216 and across R211 gives 6 dB per octave de-emphasis (roll-off) to the audio which has been pre-emphasized 6 dB per octave in the transmitter. Below 300 Hz, feedback from R213 and across C215 increases giving low frequency de-emphasis. Capacitor C238 rolls off the high frequency gain of the amplifier to prevent high frequency oscillation. Capacitors C223 and C224, C240, C241, and C242 are rf bypass capacitors that shunt stray rf on the audio A+ and audio A- lines to ground. In local operation the output secondary winding couples audio power to a 16-ohm speaker and an autotransformer. This transformer will drive up to six local desk sets.

2.6 NOISE ACTIVATED SQUELCH CIRCUIT

2.6.1 Squelch Input Circuit

2.6.1.1 The input signal from the SQUELCH control may consist of audio and noise. An input shaping network precedes U202 and passes high frequencies while attenuating low frequencies. Allowing the high frequencies to pass eliminates the effect of voice and results in more sensitive threshold squelch action.

2.6.1.2 The first amplifier and limiter is driven into limit by its input signal and prevents audio from squelching (disabling) the audio channel on voice signals. Amplified, limited noise is then passed through a coupling network to the second amplifier. This coupling network is also a high pass filter which further attenuates voice and tone signals to the second amplifier.

2.6.1.3 The second amplifier amplifies the noise signal and applies it through an RC coupling network to the detector. Capacitor C233 and C234 form another high pass filter that attenuates the low frequencies. Capacitor C234 is used to produce a peak-to-peak detector action from the noise detector, and thus, generate twice the output voltage of a peak detector. This capacitor does not affect frequency response.

2.6.2 Detector and Switching Circuits

2.6.2.1 The detector output level is a function of received signal strength and the setting of the SQUELCH control. The detector develops the dc output voltage across filter capacitor C235. The lowest dc output voltage corresponds to a no signal input (maximum noise) condition. The output voltage increases as the received rf carrier signal level increases (noise decreases).

2.6.2.2 The primary function of the detector output, however, is the control of shunt switching. This is done by applying the detector output to three squelch control circuits simultaneously:

-- long "squelch-tail" circuit

-- long "squelch-tail" defeat switch

-- carrier squelch switching logic

2.6.2.3 With no received rf carrier signal (maximum noise condition), the long "squelch tail" circuit and long "squelch tail" defeat switch are "off" and the carrier squelch switching logic is "on". The audio channel is subsequently disabled unless the squelch control logic is overridden by other circuitry.

2.6.2.4 As the input signal level increases (noise decreases), the detector output voltage increases. A detector output voltage above 2.8 volts dc results in enabling of the long "squelch tail" circuit. The long "squelch tail" circuit produces a voltage at U202-12 of 5.5 volts dc; this voltage causes the carrier squelch switching logic circuit to turn "off" and thereby enables the audio channel. Capacitor C236 and resistor R235 provide a rapid-rise, slow-decay time constant to the voltage applied to the carrier squelch switching logic circuit. This permits a weak signal to immediately enable the audio channel, yet delays the audio channel shut-off if the signal is in a "flutter" condition. The voltage necessary to enable the carrier squelch switching logic is approximately 3.8 volts dc.

2.6.2.5 A voltage greater than 5 volts dc at the detector output (rf carrier signal level that produces 20 dB quieting or better with the SQUELCH control set at threshold), turns on the long "squelch tail" defeat switch. This disables the long "squelch tail" circuit and the 150 millisecond delay function. Audio channel disabling now occurs immediately after the rf carrier disappears.

2.6.3 Squelch Output Circuit

The squelch control logic circuit directly controls the shunt switches.

2.6.3.1 The output of the squelch control logic circuit depends upon the output of the preceding carrier squelch switching logic circuit. With the carrier squelch switching logic circuit "off", the squelch control logic circuit will turn off the shunt switches, allowing a message to be heard. If the carrier squelch switching logic is "on", the squelch control logic circuit will turn on the shunt switches, disabling the audio channel, and activating the series switches in the line driver or local-logic board. Capacitor C237, connected to U202-10, slows the turn-off of the shunt switches to "soften" what would otherwise be an annoyingly abrupt turn-on of the audio. This same point (U202-10) supplies a digital output voltage that can be used as an indicator that the receiver is unsquelched (audio channel enabled).

2.6.3.2 Two additional functions that may affect the squelch control logic output are associated with "Private-Line" operation. PL disable (U202-14) may be either shorted to ground or open. When an open is present at U202-14 (PL disabled), a received signal with or without a PL code will be heard from the speaker. When at ground potential (PL enabled), the output of the carrier squelch switching logic circuit is inhibited. When the proper PL code is received, a positive 9.5 volts dc from the PL decoder board to U202-8 turns off the squelch control logic circuit which turns off the shunt switches and allows a message to be heard. Jumper JU204 is normally in the circuit and is only cut when a field modification is made. The cutting of this jumper and associated modifications on the receiver interconnect board will provide "AND-SQUELCH" operation, changing the PL squelch circuitry from fixed sensitivity operation to variable sensitivity operation. Under this mode of operation, the SQUELCH control will affect the squelch sensitivity.

2.6.3.3 Audio disabling is performed by shunting the audio circuit to ground through a low impedance path and also by the operation of a series switch in the line driver or local-logic board. When the solid state shunt switch is turned "on" (U202-7), signals developed across R236 are shunted to ground. This prevents any signals from being heard at the speaker. Acting in tandem with the first shunt switch, the second shunt switch output is routed to the line driver or local-logic board and enables a set of switches on either of the boards. In a remote control system, this breaks the audio path and prevents audio from appearing on the 600-ohm line. In a local control system, these series switches also break the audio path, thus preventing any audio or hum and noise from reaching the speaker.

3. MAINTENANCE

3.1 GENERAL

This section of the manual provides maintenance shop type procedures for the audio and squelch board. It assumes that preliminary tests have already localized the trouble to this board. These bench tests include procedures for testing and troubleshooting, including integrated circuit check-out.

NOTE

The audio and squelch board must be installed in a station for testing to provide the necessary power and ground connections.

3.2 PERFORMANCE TESTS

The performance tests may be used for troubleshooting to isolate the point of abnormal operation. They may also be used after repair to assure that the board is operating properly before it is returned to service.

3.2.1 Audio Amplification

3.2.1.1 Specifications

The audio section of the audio and squelch board combined with the separate audio power amplifier transistors will provide at least 10-watts (5 watts local) audio output at less than 5 per cent distortion from a 3.0 kHz deviated, 1 kHz modulated on-frequency signal applied to the station antenna receptacle.

3.2.1.2 Procedure

Step 1. Replace the speaker with an 8-ohm, 15-watt non-inductive resistor. In local control stations, disconnect the autotransformer.

Step 2. Set the SQUELCH control fully counterclockwise (unsquelched). "Private-Line" stations must also be PL disabled.

Step 3. Connect an rf signal generator to the station antenna receptacle and adjust it to the receiver frequency.

Step 4. Adjust the signal generator for 1000-microvolt output, modulated with 1000-Hz tone at ±5.0 kHz deviation.

Step 5. Connect an AC voltmeter to pin J903-7 at the receiver interconnect board.

Step 6. Adjust the line level control R203 for 175 mV ac rms.

Step 7. Reduce the deviation to ±3.0 kHz.

Step 8. Connect an AC voltmeter across the 8-ohm resistor.

Step 9. Adjust the VOLUME control until 9.0 volts ac rms is read on the ac voltmeter (this represents 10 watts).

Step 10. Measure distortion at 10-watts audio power output. It should be less than 5 per cent.

3.2.2 Squelch Control

3.2.2.1 Specifications

3.2.2.1.1 The squelch section of the receiver audio and squelch board shall enable the audio section when an rf signal level greater than 6 dB noise quieting (one-half the discriminator output level with no signal input) is applied to the receiver with the SQUELCH control set at threshold. When the signal is removed from the station, the audio channel shall become disabled after approximately 150 milliseconds. When an input signal greater than that required for approximately 20 dB noise quieting is removed from the station, the audio channel shall become disabled immediately.

3.2.2.1.2 When the SQUELCH control is turned fully clockwise (tight squelch) an input signal that produces about 20 dB noise quieting shall be required to enable the audio channel.

3.2.2.1.3 The squelch section shall inhibit audio output when no input signal is received.

3.2.2.1.4 In "Private-Line" stations, the squelch section of the receiver's audio and squelch board shall perform as described in paragraphs 3.2.2.1.1, .2, and .3 while the radio set is PL disabled.

3.2.2.1.5 In PL operation, the squelch section shall inhibit audio output when the proper PL code is not received, regardless of the input signal strength.

3.2.2.2 Procedure

3.2.2.2.1 Carrier Squelch Stations

Step 1. Turn the station on and adjust the SQUELCH control clockwise from the full counterclockwise position until the receiver just quiets (threshold squelch).

Step 2. Measure the resistance of U202-6 and -7 with reference to ground. Both pins should be less than 1000 ohms.

NOTE

Erroneous readings will be obtained in resistance measurements if the voltage between the ohmmeter probes exceeds approximately 5.0 volts dc.

Step 3. Connect a signal generator to the station antenna receptacle and adjust it to the receiver frequency. Modulate the generator output with a 1000-Hz tone at ±3.0 kHz deviation.

Step 4. Increase the signal generator output slowly until the receiver just unsquelches. Remove the modulation from the signal generator. Unsquelching should occur at a generator output that produces 6 dB noise quieting, or less.

Step 5. Measure the resistances of U202-6 and -7 with reference to ground. Both pins should be greater than 200,000 ohms.

Step 6. Increase the signal generator output until approximately 12 dB noise quieting is obtained. Remove the rf signal from the station input either by turning off the signal generator or by using a relay in series with the signal generator output. A long "squelch tail" should occur. If a calibrated, triggered sweep oscilloscope is available for measurement, the duration of the "squelch tail" should be approximately 150 milliseconds as measured at the speaker.

Step 7. Increase the signal generator output to produce 30 dB noise quieting. Turn off the rf signal and note the "squelch tail" duration. It should be no more than a "click". The duration should be less than 10 milliseconds.

Step 8. Turn the SQUELCH control fully clockwise (tight squelch).

Step 9. Adjust the signal generator output level until the station just unsquelches. Unsquelching should occur at a generator output that produces approximately 20 dB noise quieting.

3.2.2.2.2 "Private-Line" Stations

Step 1. Disable the PL circuitry.

Step 2. Perform previously described carrier squelch station procedure.

Step 3. Return the station to PL operation. On stations using "AND" squelch operation, also turn the SQUELCH control fully counterclockwise during this test.

Step 4. Vary generator output between minimum output and 1000 microvolt output while checking the resistances of U202-6 and -7 with reference to ground. Both resistances should remain at less than 1000 ohms.

Step 5. Modulate the on-frequency generator output with a PL code for ±0.5 to ±1 kHz deviation and 1000-Hz tone for ±3.0 kHz overall deviation.

Step 6. Increase the signal generator output slowly until the receiver just unsquelches. Unsquelching should occur at a generator output that produces 6 dB quieting, or less.

3.3 TROUBLESHOOTING

3.3.1 Check Input Voltages

A malfunction in the audio and squelch operation may be due to the loss of dc input voltages which can be caused by this board or another section of the station. Since there are only two input voltages applied to this board, it is advantageous to verify their presence before beginning extensive troubleshooting.

P903-1, -4	+9.6 V dc in respect to chassis
P903-16	Audio A+ (approximately +13.6 V dc in respect to A-)

In a negative ground system, audio A- is at chassis potential. In a positive ground system, audio A+ is at chassis potential.

3.3.2 Isolating Defective Components

If tests indicate abnormal performance, a logical troubleshooting procedure should be followed to isolate the defective component efficiently. Results of performance tests usually localize the malfunction to one or two stages. The accompanying troubleshooting chart summarizes these results in a logical sequence. A few waveforms, voltage and resistance checks in the suspected circuit should readily isolate the defective component when compared with those on the schematic diagram.

3.3.3 Troubleshooting Integrated Circuits

Integrated circuits (IC's) are very reliable components and should not be replaced until all checks have proven definitely that the IC is the defective component. Make sure that the external components in the circuit are normal. The IC's on the audio and squelch board may be checked by dc voltage measurements although signal tracing with an oscilloscope is preferred.

3.3.4 Stage Gain Measurements

3.3.4.1 Squelch Circuitry

3.3.4.1.1 This troubleshooting procedure may be used to isolate a squelch malfunction occuring before the detector to a specific stage. The test is performed by injecting an ac signal at the input to the squelch circuitry and

ioting results obtained with an ac voltmeter. Most accurate results are obtained by taking dB gain and loss measurements between points as illustrated in Figure 2. Individual point voltage checks may also be used to quickly verify proper squelch input circuitry operation but this is not an adequate test to prove the circuit is defective (refer to the following table and Figure 2). Tolerance addition may cause increasing variation from the typical readings in the table as readings are taken further from the injected signal point.

3.3.4.1.2 The following procedure may be used for loss and gain or signal level measurements while injecting a 3 kHz or 30 kHz signal. In "Private-Line" radios, PL operation will not affect this test.

Step 1. Turn the VOLUME control fully counter-clockwise (off), or to a comfortable listening level, if desired.

Step 2. Turn the SQUELCH control fully clockwire (squelched) and turn the station on.

Step 3. Inject a 1000-microvolt, on-channel signal at the station antenna receptacle. This "quiets" the discriminator output and prevents erroneous test readings.

Step 4. Inject a 3 kHz, 10 millivolt rms signal at the receiver audio & squelch board at P903-9.

Step 5. Take loss and gain measurements or signal level measurements as required.

Step 6. Repeat the preceding test using a 30 kHz signal in place of the 3 kHz signal in step 4.

3.3.4.2 Audio Circuitry

AC voltage measurements and waveforms are given where applicable on the schematic diagram. Refer to this diagram for pertinent information when taking audio stage gain measurements.

AC VOLTMETER CONNECTED TO U202-PIN	AC VOLTMETER READING WITH 3 kHz SIGNAL INPUT (mV)	AC VOLTMETER READING WITH 30 kHz SIGNAL INPUT (mV)
15	2.2	6.3
1	25	70.8
2	1.4	11.2
3	16	126
4	2.8	112

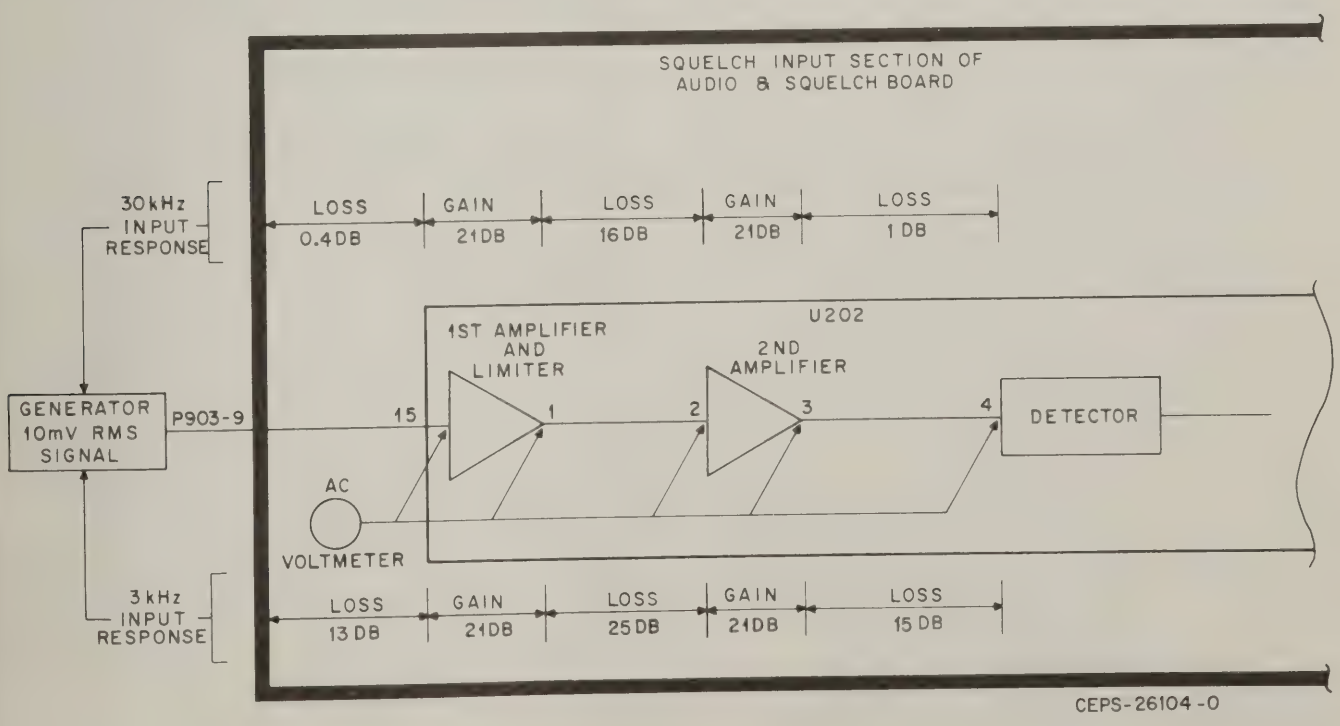
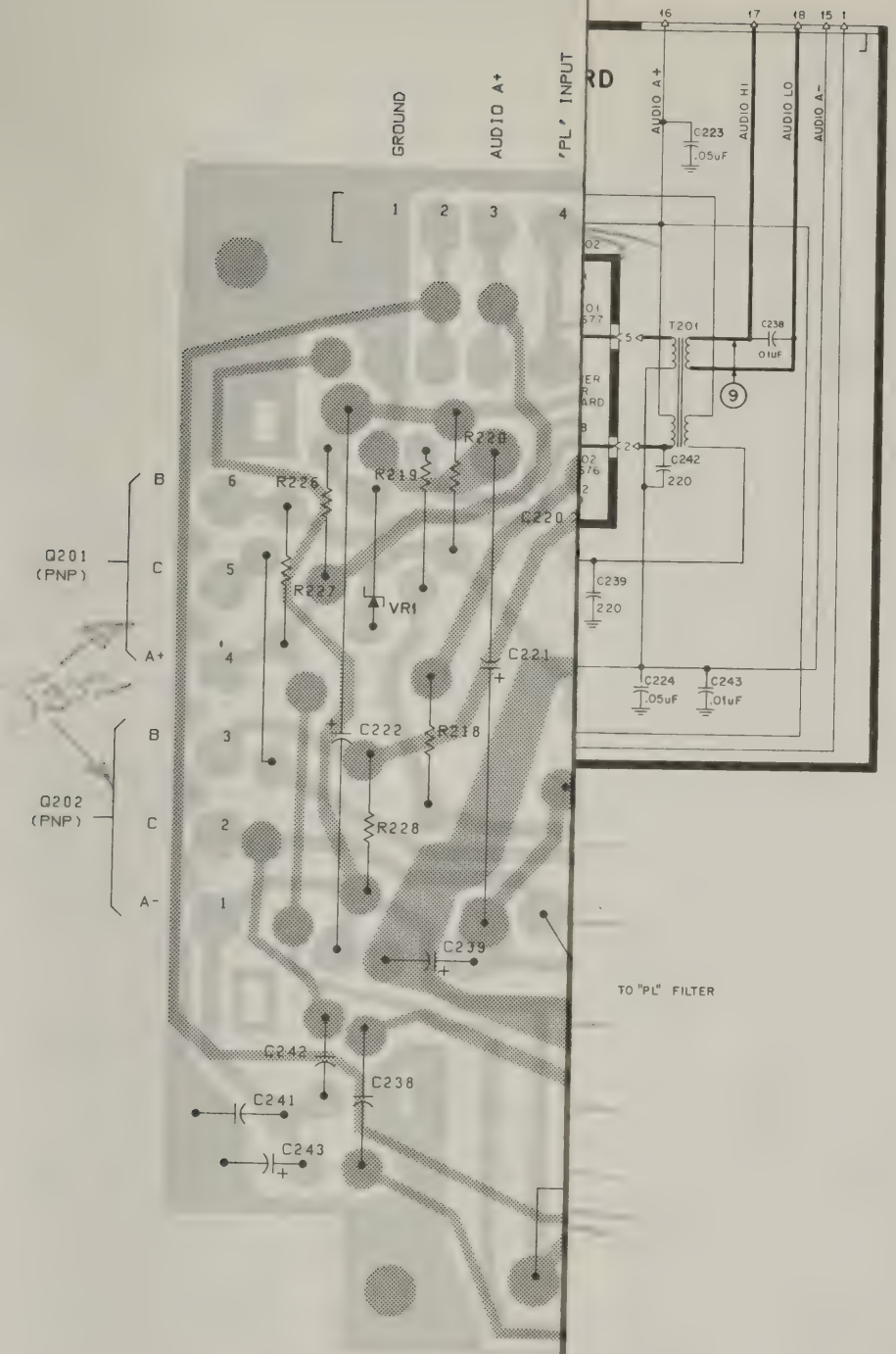


Figure 2.
Squelch Circuitry Stage Gain Measurements

A



NOTES:

201. +5.6 VOLTS WHEN THRESHOLD SIGNAL JUST OPENS SQUELCH (I.E., APPROXIMATELY 6 dB QUIETING SIGNAL WITH SQUELCH CONTROL AT THRESHOLD).
202. WHERE MORE THAN ONE VOLTAGE READING APPEARS: USQ= RECEIVER UNSQUELCHED FSQ= RECEIVER FULLY SQUELCHED
203. VOLTAGE MEASURED WITH RESPECT TO A-.
204. VOLTAGE MEASURED WITH RESPECT TO A+.
205. VOLTAGES AT U201-6 AND -7 MUST BE THE SAME VALUE.
206. UNLESS OTHERWISE STATED: CAPACITOR VALUES ARE IN PICOFARADS.
207. UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES ±10% MEASURED WITH AN 11 MEGOHM INPUT RESISTANCE VOLTMETER WITH RESPECT TO CHASSIS GROUND.
208. AUDIO POWER AMPLIFIER IS NOT PART OF AUDIO & SQUELCH BOARD.
209. JUMPER JU204 MUST BE REMOVED FOR "AND SQUELCH" OPERATION. (SEE "RECEIVER INTERCONNECT UNIT" SECTION). SEE JUMPER TABLE FOR JUMPER USE.
210. RED– WHITE WIRE CONNECTS TO C211–C213 JUNCTION IN ALL LOCAL CONTROL STATIONS AND IN LOCAL/REMOTE STATIONS WITH INTER–COM. IN ALL OTHER MODELS THE RED– WHITE WIRE CONNECTS TO P903–11.

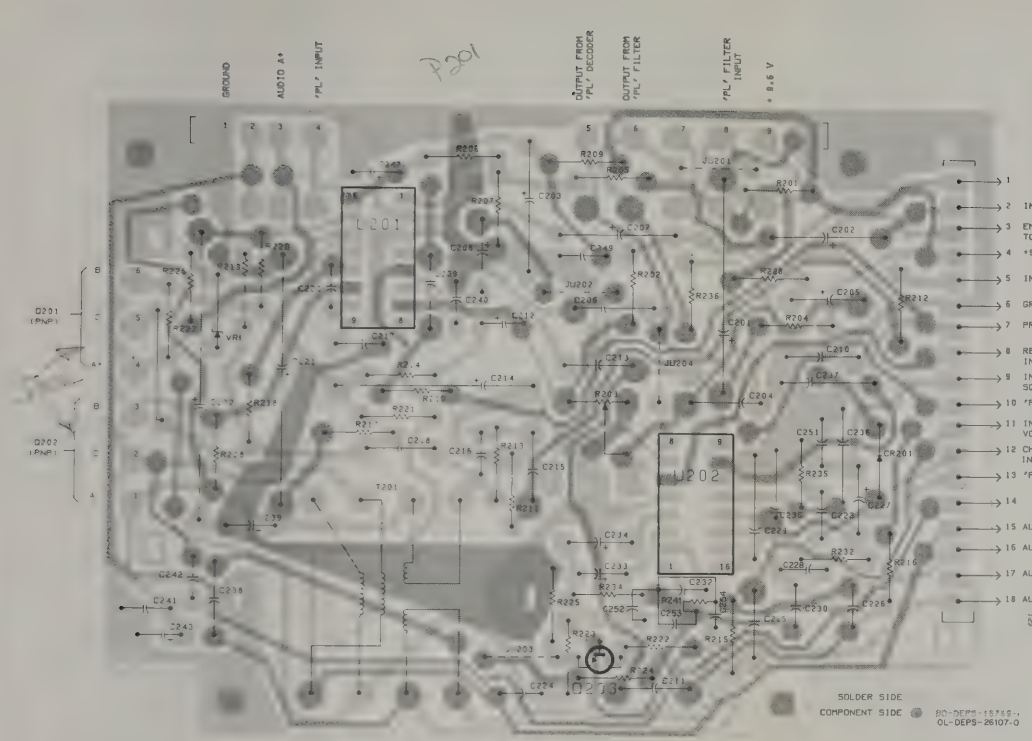
JUMPER TABLE

JUMPER	
JU201	CONNECTED IN CARRIER SQUELCH STATIONS AND "DIGITAL PRIVATE LINE" STATIONS
JU202	CONNECTED IN CARRIER SQUELCH STATIONS AND "DIGITAL PRIVATE LINE" STATIONS
JU203	CONNECTED TO PROVIDE 10 WATTS AUDIO AT SPEAKER WITH LINE LEVELS OF -10dBM OR LESS (REMOTE CONTROL STATIONS ONLY).
JU204	CUT FOR "AND SQUELCH"

RECEIVER AUDIO & SQUELCH BOARD

PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TRN8406A Audio and Squelch Board
Schematic Diagram, Circuit Board Detail, and Troubleshooting Chart
Motorola No. PEPS-26108-O
(Sheet 1 of 2)
3/30/78-NPC



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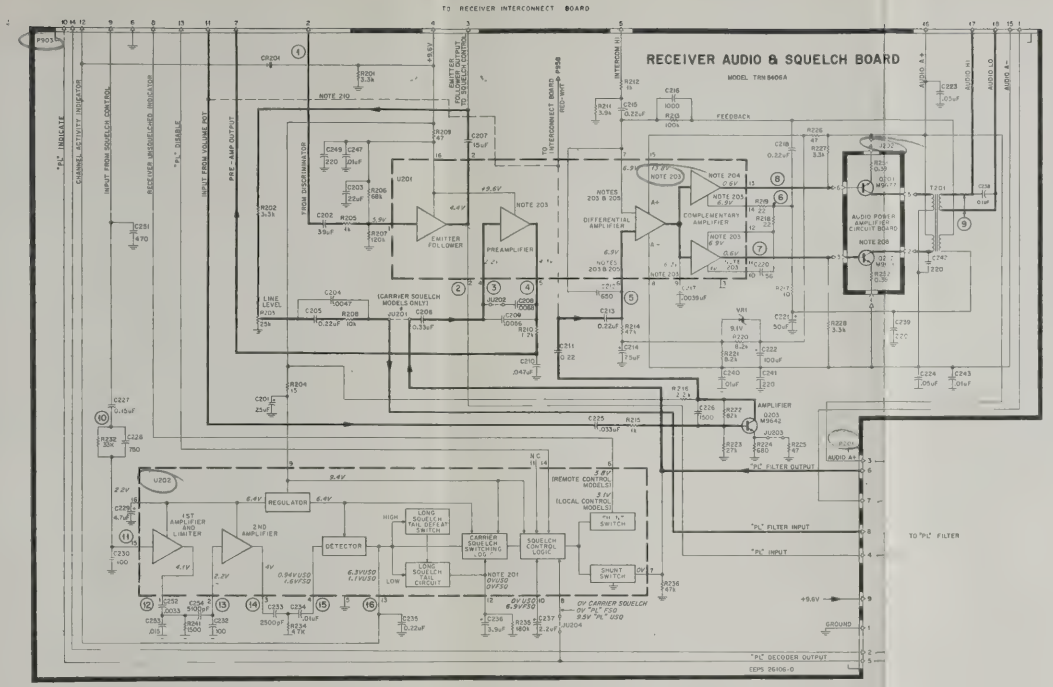


NOTES
201. +5.6 VOLTS WHEN THRESHOLD SIGNAL JUST OPENS SQUELCH (1.5 , APPROXIMATELY 6 dB QUIETING SIGNAL WITH SQUELCH CONTROL AT THRESHOLD).
202. WHERE MORE THAN ONE VOLTAGE READING APPEARS VSQ=RECEIVER UNSQUELCHED
FSQ=RECEIVER FULLY SQUELCHED
203. VOLTAGE MEASURED WITH RESPECT TO A-
204. VOLTAGE MEASURED WITH RESPECT TO A+
205. VOLTAGES AT U201-6 AND -7 MUST BE THE SAME VALUE.
206 UNLESS OTHERWISE STATED:
CAPACITOR VALUES ARE IN PICOFARADS
207 UNLESS OTHERWISE STATED, VOLTAGE MEASUREMENTS ARE FOR DC VOLTAGES +10% MEASURED WITH AN HI MEGOHM INPUT RESISTANCE VOLTMETER WITH RESPECT TO CHASSIS GROUND
208 AUDIO POWER AMPLIFIER IS NOT PART OF AUDIO & SQUELCH BOARD
209 JUMPER JU204 MUST BE REMOVED FOR "AND SQUELCH OPERATION (SEE "RECEIVER INTERCONNECT UNIT" SECTION SEE JUMPER TABLE FOR JUMPER USE.
210 RED- WHITE WIRE CONNECTS TO C211--C213 JUNCTION IN ALL LOCAL CONTROL STATIONS AND IN LOCAL/REMOTE STATIONS WITH INTER COM. IN ALL OTHER MODELS THE RED- WHITE WIRE CONNECTS TO P903-11.

JUMPER TABLE

JUMPER	
JU201	CONNECTED IN CARRIER SQUELCH STATIONS AND "DIGITAL PRIVATE LINE" STATION.
JU202	CONNECTED IN CARRIER SQUELCH STATIONS AND "DIGITAL PRIVATE LINE" STATION.
JU203	CONNECTED TO PROVIDE 10 WATTS A.[illegible] SPEAKER WITH LINE LEVELS OF +1.5W R LESS REMOTE CONTROL STATIONS. A+
JU204	CUT FOR "AND SQUELCH."

ALL SQUELCH CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER FOLLOWING CONDITIONS:

1. VERTICAL SENSITIVITY = 0.5 V/DIV.
2. HORIZONTAL DEFLECTION = 2 msec/DIV.
3. SQUELCH CONTROL FULLY CLOCKWISE (ON). NO EXTERNAL SIGNAL APPLIED.
*4. WAVEFORMS (15) AND (16) ARE DC COUPLED WITH ZERO AT BOTTOM, OTHERS AC COUPLED.

EPS-6534-O

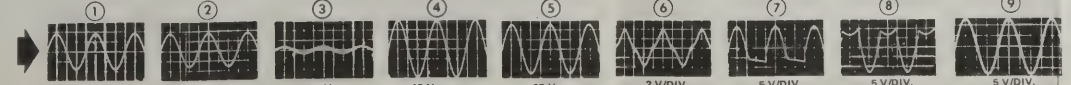
SQUELCH CIRCUIT WAVEFORMS

ALL AUDIO CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER THE FOLLOWING CONDITIONS:

1. VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM
2. HORIZONTAL DEFLECTION - 25 msec/DIV
3. SQUELCH CONTROL FULLY COUNTERCLOCKWISE (OFF). 1000 uV RF SIGNAL INPUT MODULATED WITH 1000 Hz TONE WITH +3.0 kHz DEVIATION.
4. VOLUME CONTROL SET FOR 9.0 V rms AT LOAD
5. OUTPUT TERMINATED IN 8 OHM LOAD
6. R203 SET FOR .175 mV AT PIN 7 WITH +5 kHz DEVIATION (1 kHz TONE)

EPS 8804 O

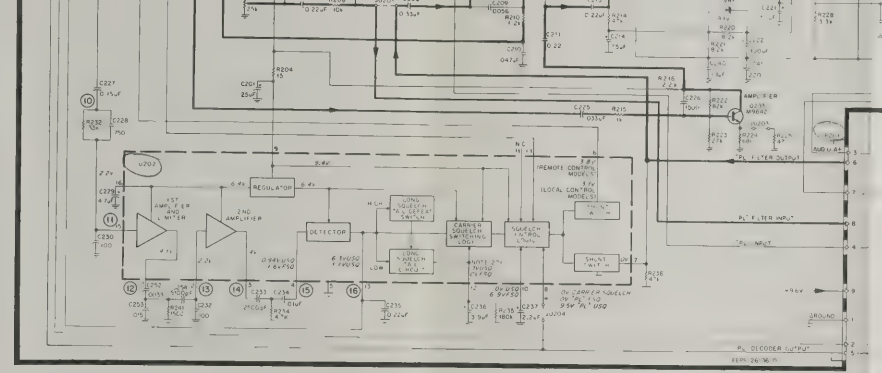
AUDIO CIRCUIT WAVEFORMS



PARTS LIST SHOWN ON BACK OF THIS DIAGRAM

TRN8406A Audio and Squelch Board Schematic Diagram, Circuit Board Detail, and Troubleshooting Chart
Motorola No. PEPS-26108-O
(Sheet 1 of 2)
3/30/78-NPC

SHOWN FROM SOLDER SIDE



ALL SQUELCH CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER FOLLOWING CONDITIONS:

1. VERTICAL SENSITIVITY = 0.5 V/DIV.
2. HORIZONTAL DEFLECTION = 2 msec/DIV
3. SQUELCH CONTROL FULLY CLOCKWISE (ON), NO EXTERNAL SIGNAL APPLIED.
*4. WAVEFORMS (15) AND (16) ARE DC COUPLED WITH ZERO AT BOTTOM, OTHERS AC COUPLED.

EPS-8534-O

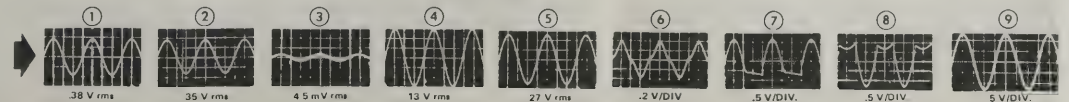
SQUELCH CIRCUIT WAVEFORMS

ALL AUDIO CIRCUIT OSCILLOSCOPE WAVEFORMS TAKEN UNDER THE FOLLOWING CONDITIONS

1. VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM
2. HORIZONTAL DEFLECTION = 25 msec/DIV
3. SQUELCH CONTROL FULLY COUNTERCLOCK WISE (OFF). 1000 uV RF SIGNAL INPUT MODULATED WITH 1000 Hz TONE WITH ±3.0 kHz DEVIATION.
4. VOLUME CONTROL SET FOR 9.0 V rms AT LOAD
5. OUTPUT TERMINATED IN 8 OHM LOAD
6. R203 SET FOR 175 mV AT PIN 7 WITH ±5 kHz DEVIATION (1 kHz TONE)

EPS 8804-O

AUDIO CIRCUIT WAVEFORMS



PARTS LIST SHOWN ON
BACK OF THIS DIAGRAM

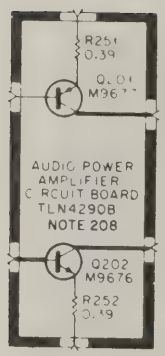
TRN8406A Audio and Squ
Schematic Diagram, Cir
and Troubleshooting Cha
Motorola No. PEPS-2610
(Sheet 1 of 2)
3/30/78-NPC

AUDIO POWER AMPLIFIER

MODEL TLN4290B

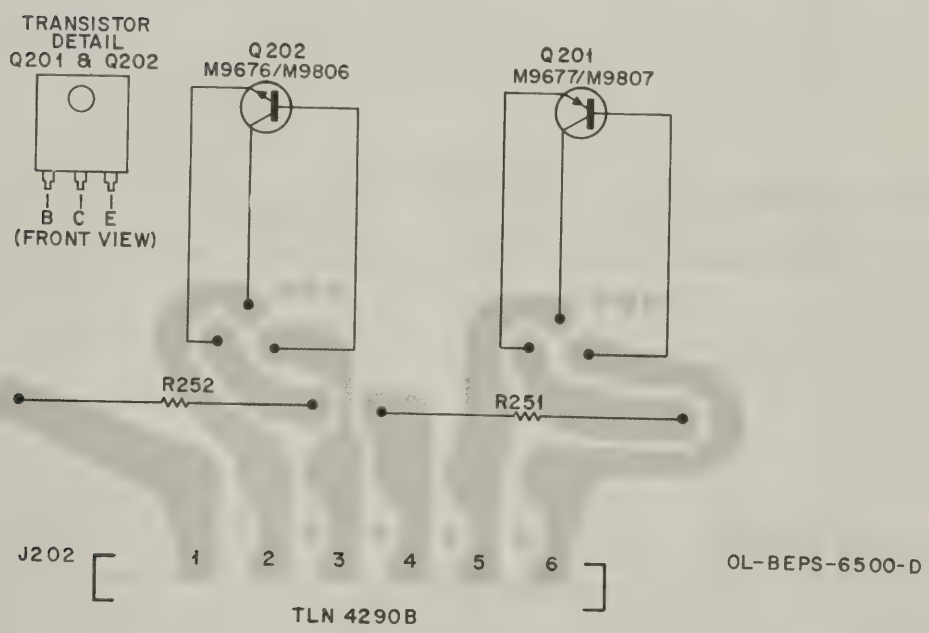
FUNCTION --

Provides up to 10 watts audio output.



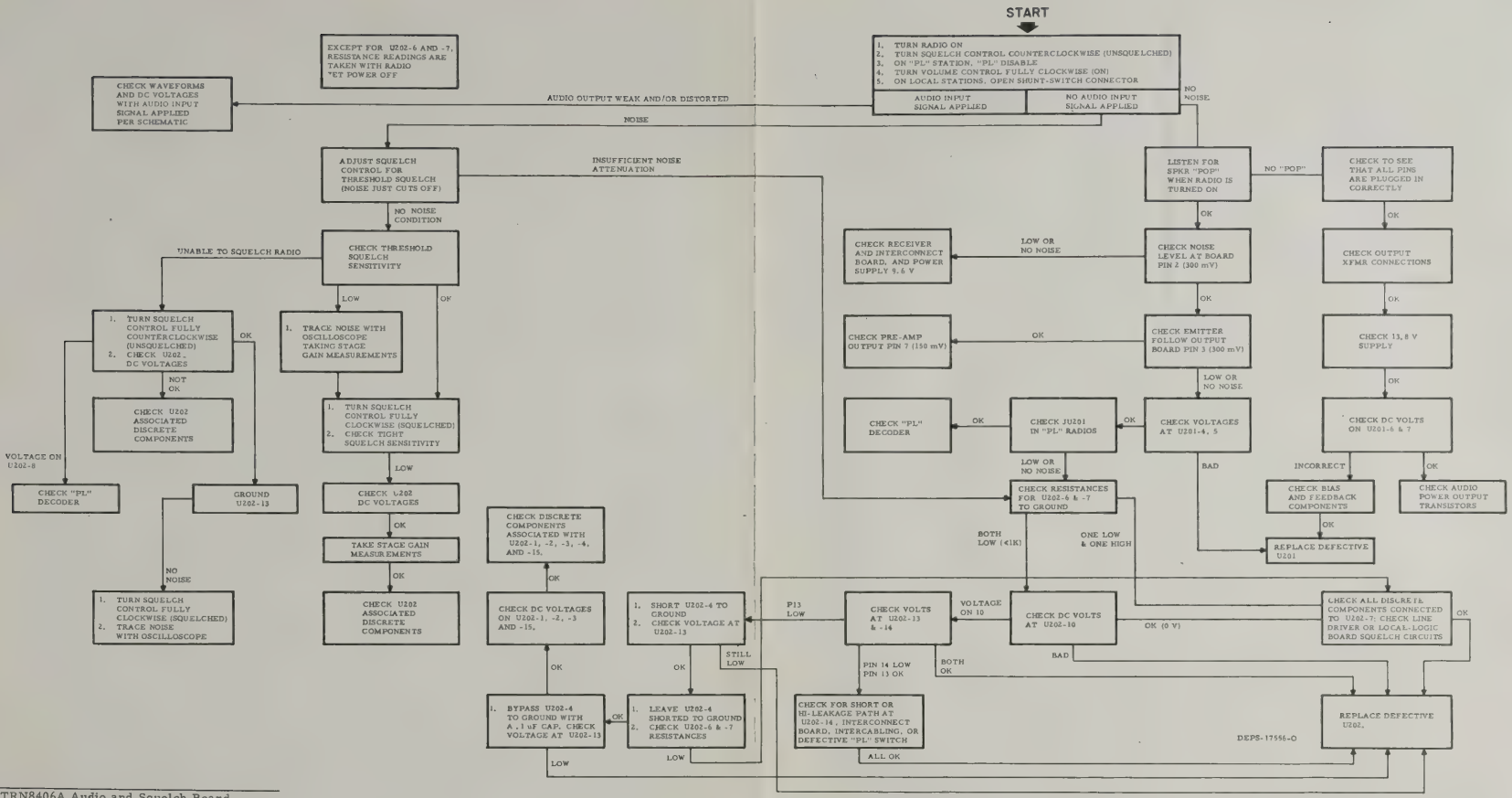
AUDIO POWER AMPLIFIER

SHOWN FROM SOLDER SIDE



NOTE

208. AUDIO POWER AMPLIFIER IS NOT PART OF AUDIO & SQUELCH BOARD.


START
1. TURN RADIO ON
2. TURN SQUELCH CONTROL COUNTERCLOCKWISE (UNSQUELCHED)
3. ON "PL" STATION, "PL" DISABLE
4. TURN VOLUME CONTROL FULLY CLOCKWISE (ON)
5. ON LOCAL STATIONS, OPEN SHUNT-SWITCH CONNECTOR
AUDIO INPUT SIGNAL APPLIED
NO AUDIO INPUT SIGNAL APPLIED
NO NOISE
AUDIO OUTPUT WEAK AND/OR DISTORTED
NOISE
EXCEPT FOR U202-6 AND -7, RESISTANCE READINGS ARE TAKEN WITH RADIO "ET POWER OFF
CHECK WAVEFORMS AND DC VOLTAGES WITH AUDIO INPUT SIGNAL APPLIED PER SCHEMATIC
ADJUST SQUELCH CONTROL FOR THRESHOLD SQUELCH (NOISE JUST CUTS OFF)
INSUFFICIENT NOISE ATTENUATION
NO NOISE CONDITION
UNABLE TO SQUELCH RADIO
CHECK THRESHOLD SQUELCH SENSITIVITY
LOW
OK
1. TURN SQUELCH CONTROL FULLY COUNTERCLOCKWISE (UNSQUELCHED)
2. CHECK U202 DC VOLTAGES
OK
NOT OK
CHECK U202 ASSOCIATED DISCRETE COMPONENTS
1. TRACE NOISE WITH OSCILLOSCOPE TAKING STAGE GAIN MEASUREMENTS
1. TURN SQUELCH CONTROL FULLY CLOCKWISE (SQUELCHED)
2. CHECK TIGHT SQUELCH SENSITIVITY
LOW
CHECK U202 DC VOLTAGES
OK
TAKE STAGE GAIN MEASUREMENTS
OK
CHECK U202 ASSOCIATED DISCRETE COMPONENTS
VOLTAGE ON U202-8
CHECK "PL" DECODER
GROUND U202-13
NO NOISE
1. TURN SQUELCH CONTROL FULLY CLOCKWISE (SQUELCHED)
2. TRACE NOISE WITH OSCILLOSCOPE
CHECK DISCRETE COMPONENTS ASSOCIATED WITH U202-1, -2, -3, -4, AND -15.
OK
CHECK DC VOLTAGES ON U202-1, -2, -3 AND -15.
OK
1. BYPASS U202-4 TO GROUND WITH A .1 uF CAP. CHECK VOLTAGE AT U202-13
OK
LOW
1. SHORT U202-4 TO GROUND
2. CHECK VOLTAGE AT U202-13
OK
STILL LOW
1. LEAVE U202-4 SHORTED TO GROUND
2. CHECK U202-6 & -7 RESISTANCES
LOW
P13 LOW
CHECK VOLTS AT U202-13 & -14
VOLTAGE ON 10
PIN 14 LOW PIN 13 OK
CHECK FOR SHORT OR HI-LEAKAGE PATH AT U202-14, INTERCONNECT BOARD, INTERCABLING, OR DEFECTIVE "PL" SWITCH
ALL OK
CHECK DC VOLTS AT U202-10
OK (0 V)
BOTH OK
BAD
REPLACE DEFECTIVE U202
DEPS-17556-O
CHECK ALL DISCRETE COMPONENTS CONNECTED TO U202-7; CHECK LINE DRIVER OR LOCAL LOGIC BOARD SQUELCH CIRCUITS
OK
BOTH LOW (<1K)
ONE LOW & ONE HIGH
CHECK RESISTANCES FOR U202-6 & -7 TO GROUND
LOW OR NO NOISE
CHECK "PL" DECODER
OK
CHECK JU201 IN "PL" RADIOS
OK
CHECK VOLTAGES AT U201-4, 5
BAD
REPLACE DEFECTIVE U201
LISTEN FOR SPKR "POP" WHEN RADIO IS TURNED ON
NO "POP"
OK
CHECK NOISE LEVEL AT BOARD PIN 2 (300 mV)
LOW OR NO NOISE
OK
CHECK EMITTER FOLLOW OUTPUT BOARD PIN 3 (300 mV)
LOW OR NO NOISE
OK
CHECK PRE-AMP OUTPUT PIN 7 (150 mV)
OK
CHECK RECEIVER AND INTERCONNECT BOARD, AND POWER SUPPLY 9.6 V
LOW OR NO NOISE
CHECK TO SEE THAT ALL PINS ARE PLUGGED IN CORRECTLY
OK
CHECK OUTPUT XFMR CONNECTIONS
OK
CHECK 13.8 V SUPPLY
OK
CHECK DC VOLTS ON U201-6 & 7
INCORRECT
OK
CHECK BIAS AND FEEDBACK COMPONENTS
OK
CHECK AUDIO POWER OUTPUT TRANSISTORS

TRN8406A Audio and Squelch Board
Schematic Diagram, Circuit Board Detail
and Troubleshooting Chart
Motorola No. PEPS-26108-O
(Sheet 2 of 2)
3/30/78-NPC

PARTS LIST

TRN8406A Audio and Squelch Board PL-5930-O

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION
		CAPACITOR, fixed; uF; ±10%; 100 V; unl. stated
C201	23-83210A01	25 +150-10%; 25 V
C202	23-82783B36	39; 10 V
C203	23-84762H10	22 ±20%; 15 V
C204	8-83813H12	.0047
C205	[illegible]	[illegible]
C206	8-83813H29	0.33; 50 V
C207	23-82783B24	15; 25 V
C208	8-83813H01	.0068
C209	8-83813H26	.0056 ±5%; 50 V
C210	8-82905C03	.047; 20 V
C211	8-83813H11	0.22; 75 V
C212	21-848236	650 pF ±5%; 500 V
C213	8-83813H11	0.22; 75 V
C214	23-84081B03	75 +150-10%; 15 V
C215	8-83813H11	0.22; 75 V
C216	21-82187B46	1000 pF
C217	21-82187B43	.0039; 200 V
C218	8-83813H11	0.22; 75 V
C219		NOT USED
C220	21-83406D46	56 pF ±5%; 500 V; N150
C221	23-84081B01	50 +100-10%; 25 V
C222	23-83210A08	100 +150-10%; 25 V
C223, 224	21-82372C04	.05 +80-20%; 25 V
C225	8-82905C16	.033
C226	21-82187B31	1500 pF ±10%; 100 V
C227	8-83813H07	0.15; 75 V
C228	21-84494B22	750 pF ±5%
C229	23-84762H07	4.7 ±20%; 10 V
C230	21-84426B06	100 pF ±5%; 500 V
C231		NOT USED
C232	21-82133G03	100 pF ±5%; 500 V; N750
C233	21-863296	2500 pF ±2%
C234	8-83813H31	.01; 100 V
C235	8-83813H11	0.22; 75 V
C236	23-84762H08	3.9 ±20%; 15 V
C237	23-84762H04	2.2 ±20%; 25 V
C238	21-82372C01	0.1 +80-20%; 25 V
C239	21-83596E10	220 pF ±20%; 500 V
C240	21-832501	.01 +60-40%; 250 V
C241, 242	21-83596E10	220 pF ±20%; 500 V
C243	21-832501	.01 +60-40%; 250 V
C244		NOT USED
C245, 246		NOT USED
C247	21-832501	.01 +60-40%; 250 V
C249	21-83596E10	220 pF ±20%; 500 V
C251	21-84426B11	470 pF ±5%; 500 V
C252	8-82905C25	.0033
C253	8-82905C15	.015
C254	21-874354	5100 pF ±5%
		DIODE: (SEE NOTE)
CR201	48-83654H01	silicon
		CONNECTOR, plug:
P201		consists of contact pins mounted on circuit board
		TRANSISTOR: (SEE NOTE)
Q203	48-869642	NPN; type M9642
		RESISTOR, fixed: ±5%; 1/4 W; unl. stated
R201, 202	6-124A61	3.3k
R203	18-83083G24	variable; 25k ±30%
R204	6-124C05	15 ±10%

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
R205	6-124A49	1k
R206	6-124A93	68k
R207	6-124A[illegible]	120k
R208	6-124A73	10k
R209	6-124C17	47 ±10%
R210	6-124A51	1.2k
R211	6-124A63	3.9k
R212	6-124A49	1k
R213	6-124C97	100k ±10%
R214	[illegible]	47k
R215	6-124A49	1k
R216	6-124A57	2.2k
R217	6-124C01	10 ±10%
R218, 219	6-124A09	22
R220, 221	6-124A71	8.2k
R222	6-124A95	82k
R223		NOT USED
R224	6-124A45	680
R225, 226	[illegible]	47
R227, 228	[illegible]	3.3k
R229 (see note)	[illegible]	NOT USED
R230	[illegible]	33k
R231	[illegible]	NOT USED
R232	[illegible]	1.5k
R233	[illegible]	47k
R234	[illegible]	[illegible]
R235	[illegible]	[illegible]
R236	[illegible]	47k
R240	[illegible]	[illegible]
R241	6-124A53	1.5k
		TRANSFORMER:
T201	[illegible]	[illegible] sec: res[illegible] feedback [illegible]
		INTEGRATED CIRCUIT (SEE NOTE)
U201	51-84267A08	type SC[illegible]
U202	51-84267A09	type SC6709
		DIODE:
VR1	48-83256C30	Zener, [illegible]

NOT REFERENCED ITEMS

	[illegible]	[illegible]
	3-138162	SCREW, tapping: [illegible] for [illegible]
	55-84300B01	HANDLE ([illegible]
	55-84300B02	[illegible]
	29-84[illegible]	[illegible] (long)
	[illegible]	[illegible] screw

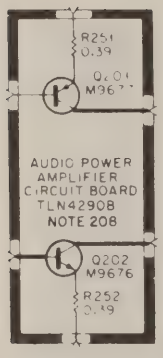
NOTE: Replacement [illegible] Motorola part number only for [illegible]

AUDIO POWER AMPLIFIER

MODEL TLN4290B

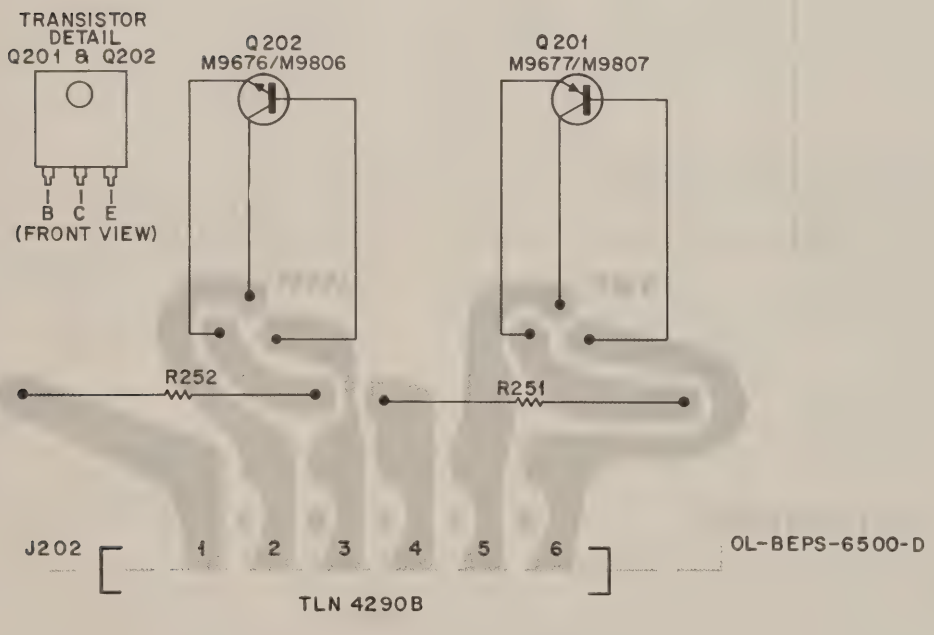
FUNCTION --

Provides up to 10 watts audio output.



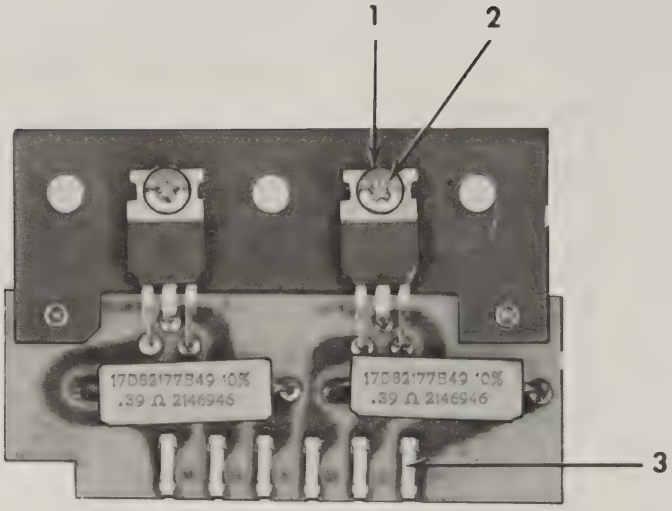
AUDIO POWER AMPLIFIER

SHOWN FROM SOLDER SIDE



NOTE

208. AUDIO POWER AMPLIFIER IS NOT PART OF AUDIO & SQUELCH BOARD.



AEPS-6502-O

AUDIO POWER AMPLIFIER

TLN4290B Audio Power Amplifier PL-1062-B

CODE NO.	MOTOROLA PART NO.	DESCRIPTION
1	4B84180C01	WASHER, shoulder
2	3S129841	SCREW, machine: No. 4-40 x 1/4"; incl. lockwasher
3	9B83011H01	PIN, female

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

AUDIO POWER AMPLIFIER

TLN4290B Audio Power Amplifier PL-1061-D

J202		CONNECTOR, receptacle: c/o; 9B83011H01 PIN, female; 6 req'd
		TRANSISTOR: (SEE NOTE)
Q201	48R869807 or48R869677	PNP; type M9807 PNP; type M9677
Q202	48R869806 or48R869676	NPN; type M9806 NPN type M9676
		RESISTOR, fixed: ±10%; 3 W:
R251	17D82177B49	0.39
R252	17D82177B49	0.39
	MECHANICAL PARTS	
1	4B84180C01	WASHER, shoulder
2	3S129841	SCREW, machine: No. 4-40 x 1/4"; incl. lockwasher
3	9B83011H01	PIN, female

TECHNICAL C

ONE "PRIVATE-LINE" DECODER

MODEL TRN6002A

FREQUENCY DETERMINING DEVICE
"PL" TONE FREQUENCY
TONE ACCURACY
TONE BANDWIDTH
TONE SENSITIVITY
OUTPUT
POWER REQUIREMENT

FUNCTION --

Unsquelches receiver upon receipt of proper "Private-Line" tone.

1. DESCRIPTION

This decoder provides a dc output voltage to unsquelch the receiver's audio section only when the proper PL tone is received. The decoder will respond only to a specific, continuous low-frequency tone from a transmitter in the same "Private-Line" network.

2. FUNCTIONAL OPERATION

2.1 GENERAL

2.1.1 "PL" Tone Present

2.1.1.1 The PL filter passes low frequency PL tones and attenuates signals above 300 Hz. The noise switch shorts out high frequency noise signals. The tone from the PL filter is limited to a fixed level by the amplifier/clipper and then applied to the "Vibrasponder" resonant reed which vibrates when the tone is the same frequency as the reed's resonant frequency. When the reed is vibrating, the tone is applied to a detector which develops a dc output which activates the output switch. When the output switch is activated, 9.5 volts is present at its output to enable the audio circuits. The output also activates the noise switch.

2.1.1.2 A separate high pass audio filter is located on the PL decoder board which allows voice signals above 300 Hz to pass but blocks PL tones. This filter is connected in series with the audio signal path to prevent the PL tone from being heard in the speaker.

2.1.2 "PL" Tone Absent

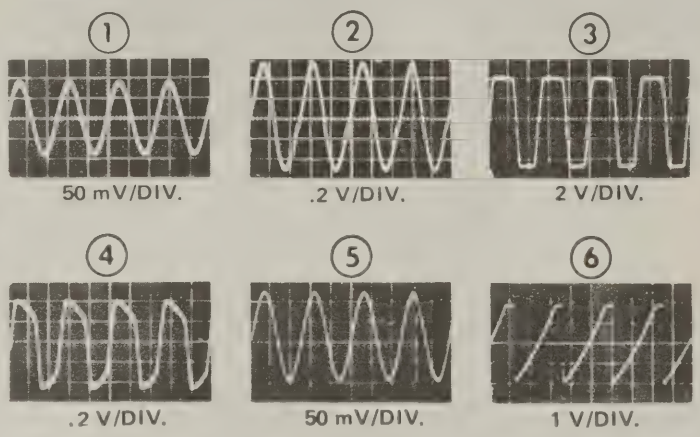
When no PL tone is present, the output switch is off. The output voltage is 0 volts at this time which inhibits the squelch circuit to prevent an audio output to the speaker. The noise switch is off at this time which allows high frequency noise to bypass the PL filter. The presence of high frequency noise desensitizes the amplifiers and acts as an "anti-falsing" feature to prevent a random low-frequency noise signal from activating the resonant reed.

2.2 DECODER INPUT CIRCUITS

2.2.1 The receiver discriminator output signal consists of noise only when no carrier signal is being received. With a carrier signal input to the receiver, the noise is reduced and voice audio or voice audio and PL tone added.

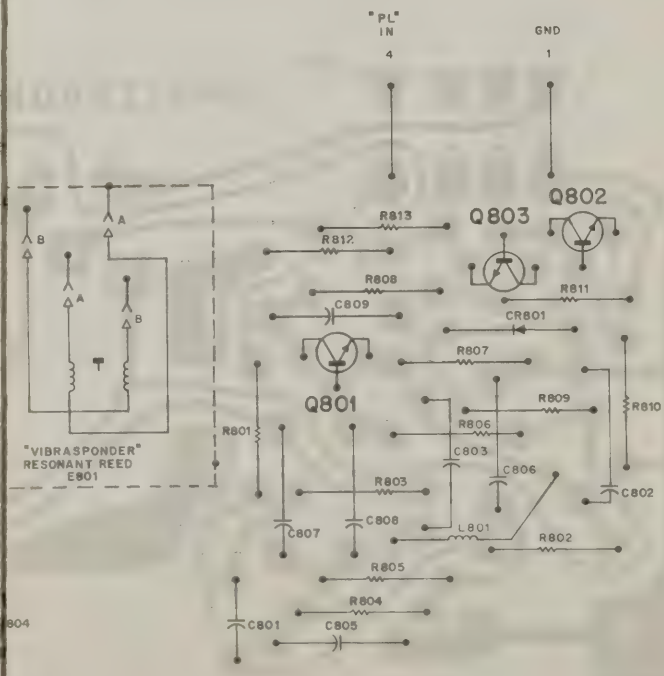
2.2.2 These input signals are routed through the low pass filter and noise gate circuit. A receiver input signal that is modulated ±0.05 kHz with PL tone produces a nominal 60 millivolts rms signal at the input to the decoder. The low pass filter consisting of L801, C802, C803 and C805 attenuates sharply all signals above 300 Hz. Thus voice and noise signals above 300 Hz are blocked,

TONE "PL" DECODER WAVEFORMS



EPS-6182-C

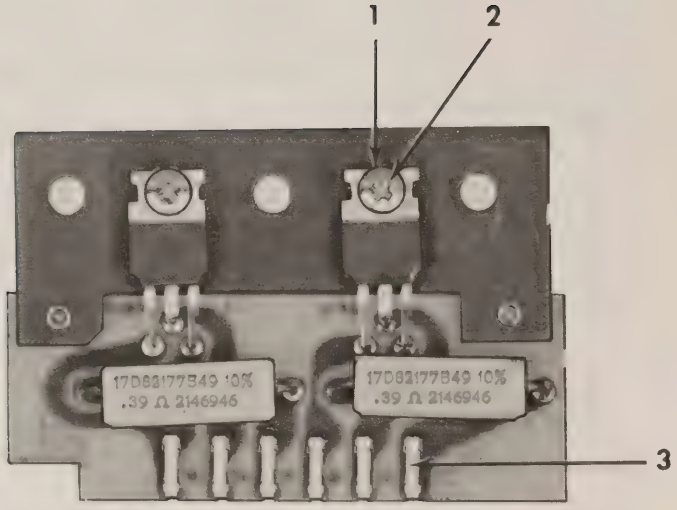
VERSION



BD-CEPS-21107-0
OL-CEPS-21108-0

TONE "PRIVATE-LINE" DECODER

68P81026E73-F
11/22/77



AEPS-6502-O

AUDIO POWER AMPLIFIER

TLN4290B Audio Power Amplifier PL-1062-B

CODE NO.	MOTOROLA PART NO.	DESCRIPTION
1	4B84180C01	WASHER, shoulder
2	3S129841	SCREW, machine: No. 4-40 x 1/4"; incl. lockwasher
3	9B83011H01	PIN, female

REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

AUDIO POWER AMPLIFIER

TLN4290B Audio Power Amplifier PL-1061-D

J202		CONNECTOR, receptacle: c/o; 9B83011H01 PIN, female; 6 req'd
		TRANSISTOR: (SEE NOTE)
Q201	48R869807	PNP; type M9807
	or48R869677	PNP; type M9677
Q202	48R869806	NPN; type M9806
	or48R869676	NPN type M9676
		RESISTOR, fixed: ±10%; 3 W:
R251	17D82177B49	0.39
R252	17D82177B49	0.39
	MECHANICAL PARTS	
1	4B84180C01	WASHER, shoulder
2	3S129841	SCREW, machine: No. 4-40 x 1/4"; incl. lockwasher
3	9B83011H01	PIN, female

TECHNICAL CHARACTERISTICS

FREQUENCY DETERMINING DEVICE	"Vibrasponder" resonant reed
"PL" TONE FREQUENCY	Selected from 67-210 Hz range
TONE ACCURACY	±0.15%
TONE BANDWIDTH	Approximately 1 Hz
TONE SENSITIVITY	0.25 volt ac rms reed drive
OUTPUT	9.5 volts dc switched
POWER REQUIREMENT	9.6 volts dc @15 milliamperes

1. DESCRIPTION

This decoder provides a dc output voltage to unsquelch the receiver's audio section only when the proper PL tone is received. The decoder will respond only to a specific, continuous low-frequency tone from a transmitter in the same "Private-Line" network.

2. FUNCTIONAL OPERATION

2.1 GENERAL

2.1.1 "PL" Tone Present

2.1.1.1 The PL filter passes low frequency PL tones and attenuates signals above 300 Hz. The noise switch shorts out high frequency noise signals. The tone from the PL filter is limited to a fixed level by the amplifier/clipper and then applied to the "Vibrasponder" resonant reed which vibrates when the tone is the same frequency as the reed's resonant frequency. When the reed is vibrating, the tone is applied to a detector which develops a dc output which activates the output switch. When the output switch is activated, 9.5 volts is present at its output to enable the audio circuits. The output also activates the noise switch.

2.1.1.2 A separate high pass audio filter is located on the PL decoder board which allows voice signals above 300 Hz to pass but blocks PL tones. This filter is connected in series with the audio signal path to prevent the PL tone from being heard in the speaker.

2.1.2 "PL" Tone Absent

When no PL tone is present, the output switch is off. The output voltage is 0 volts at this time which inhibits the squelch circuit to prevent an audio output to the speaker. The noise switch is off at this time which allows high frequency noise to bypass the PL filter. The presence of high frequency noise desensitizes the amplifiers and acts as an "anti-falsing" feature to prevent a random low-frequency noise signal from activating the resonant reed.

2.2 DECODER INPUT CIRCUITS

2.2.1 The receiver discriminator output signal consists of noise only when no carrier signal is being received. With a carrier signal input to the receiver, the noise is reduced and voice audio or voice audio and PL tone added.

2.2.2 These input signals are routed through the low pass filter and noise gate circuit. A receiver input signal that is modulated ±0.05 kHz with PL tone produces a nominal 60 millivolts rms signal at the input to the decoder. The low pass filter consisting of L801, C802, C803 and C805 attenuates sharply all signals above 300 Hz. Thus, voice and noise signals above 300 Hz are blocked, but PL tones are passed. High pass filter C801, R803, and C807 presents a parallel path for high frequency noise whenever the decoder is not activated. This condition is desirable so that low frequency noise (only) will not falsely activate the decoder. When the proper tone has been received and the decoder is activated, noise switch Q807 acts as a short and grounds all high frequency signals before they reach amplifier Q801.

2.3 INPUT AMPLIFIER CIRCUITS

Amplifier Q801 amplifies noise and PL tone signals which are coupled to amplifier/clipper Q802. Diode CR801 and the base emitter junction of Q802 limit both the positive and negative swing of the signal to a maximum amplitude. The amplified output of Q802 provides a constant amount of drive even though the amount of PL tone deviation from various transmitters is not constant. It also limits the noise signals to prevent oversensitivity to noise signals which could falsely operate the "Vibrasponder" resonant reed. "Vibrasponder" driver Q803 operates as an emitter follower to provide current drive to the low impedance "Vibrasponder" resonant reed.

2.4 "VIBRASPONDER" RESONANT REED

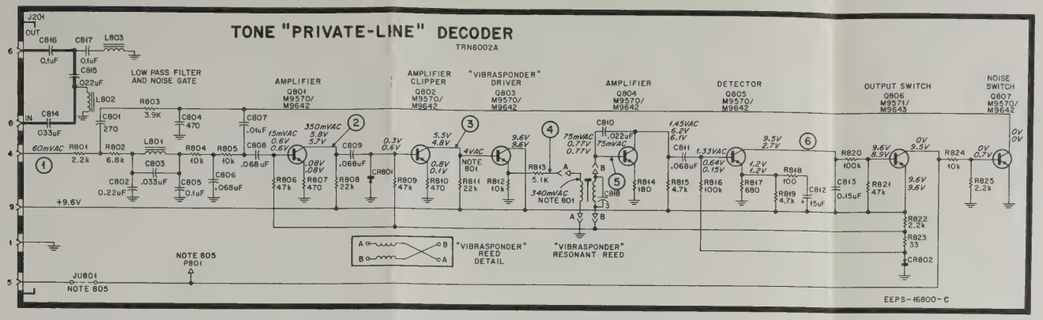
At resonance, the reed acts as a high Q transformer coupling energy from the primary to the secondary winding. At all other frequencies, the reed will not vibrate and no energy is coupled to the secondary winding.

2.5 OUTPUT CIRCUIT

When the proper PL tone is applied to the reed, it develops a sinusoidal wave output at its resonant frequency. This sinusoidal wave is amplified by Q804. Negative feedback through C810 maintains the sinusoidal waveform. The amplified signal is coupled to detector Q805 which converts the signal to a dc potential. Q805 is cut off with its collector voltage of 9.6 volts until the tone is applied. With tone applied, the positive most portion of the sinusoidal wave is clamped at approximately .6 volt. The positive swing of each cycle causes momentary conduction of Q805 and the collector voltage drops to near zero volts. C813 charges during the conduction period and discharges through R820 and R821 to develop a filtered dc potential which forward biases output switch Q806. With Q806 activated, 9.6 volts is gated to the output which unsquelches the receiver. Noise switch Q807 is also activated which places a short across the noise gate as explained in paragraph (b).

2.6 AUDIO FILTER

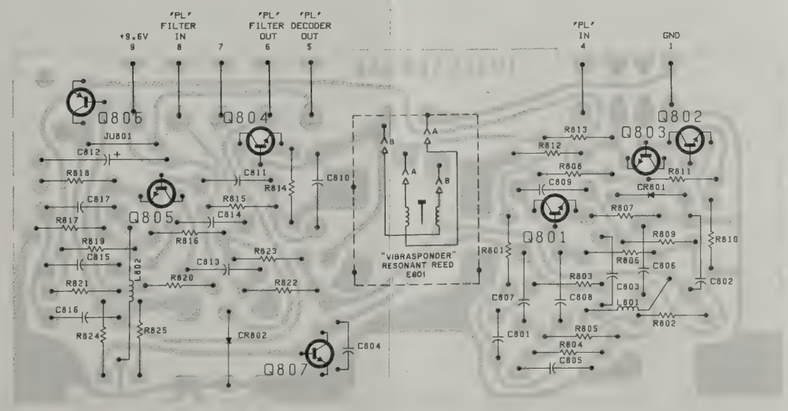
Audio and PL tone from the VOLUME control are routed through an audio filter consisting of C814-C817 and L802 and L803. The filter is electrically separate from the decoder but physically mounted on the same board. This filter is high-pass type which blocks the PL tone and passes the audio to the audio & squelch board.



NOTES:

801. DUE TO SQUARE WAVE CHARACTERISTIC SOME METERS RESPOND DIFFERENTLY. VOLTAGE SHOULD BE MEASURED WITH AN OSCILLOSCOPE.
802. AC VOLTAGE READINGS ARE RMS VALUES WITH 60 MILLIVOLTS "PL" TONE INPUT. USE HIGH IMPEDANCE (10 MEGOHM) AC VOLTMETER. MEASUREMENT MADE WITH RESPECT TO CHASSIS GROUND.
803. DC VOLTAGE READINGS TAKEN WITH HIGH IMPEDANCE (11 MEGOHM) DC VOLTMETER. TOP VALUE IS MEASURED WITHOUT "PL" TONE. BOTTOM VALUE IS MEASURED WITH 60 MILLIVOLTS "PL" TONE INPUT. MEASUREMENT MADE WITH RESPECT TO CHASSIS GROUND.
804. UNLESS OTHERWISE STATED: RESISTOR VALUES ARE IN OHMS; CAPACITOR VALUES ARE IN PICOFARADS.
805. JUMPER J1801 AND P801 ARE INCORPORATED IN MODEL TRN6002A ONLY. J1801 IS REMOVED AND P801 IS USED ONLY FOR CERTAIN OPTIONAL EQUIPMENT.

EARLIER VERSION



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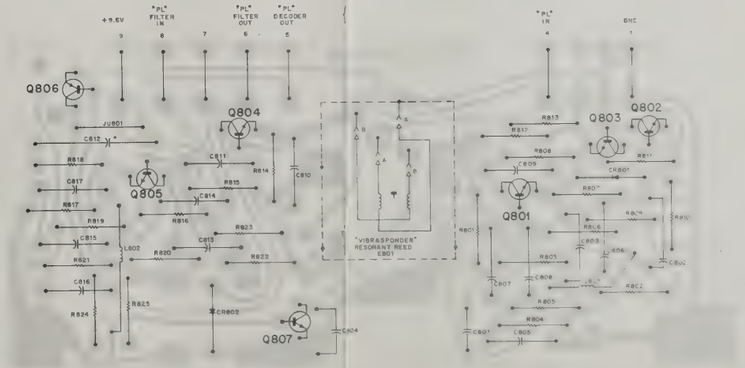
OL-CEPS-16802-B

LATER VERSION



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80-CEPS-21107-C
OL-CEPS-21108-C

TONE "PRIVATE-LINE" DECODER

MODEL TRN6002A

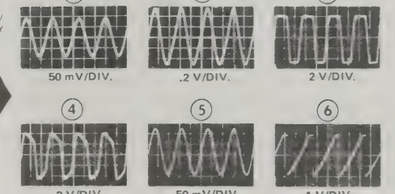
FUNCTION

Unsquelches receiver upon receipt of proper "Private-Line" tone.

WAVEFORMS MEASURED UNDER FOLLOWING CONDITIONS

1. VERTICAL SENSITIVITY SHOWN UNDER EACH WAVEFORM
2. HORIZONTAL DEFLECTION = 5 msec/DIV
3. WITH RECEIVER OPERATING PROPERLY
   - A. INJECT 1000 uV RF CARRIER AT ANTENNA CONNECTOR
   - B. MODULATE CARRIER WITH "PL" TONE. ADJUST MODULATION FOR WAVEFORM ① I.E. 60 mV rms (170 mV P-P) AT J201-2
4. RECEIVER NOT USED
   - A. INJECT "PL" TONE AT J201-2
   - B. ADJUST TONE LEVEL FOR WAVEFORM ①
5. OSCILLOSCOPE VERTICAL INPUT -- AC
6. OSCILLOSCOPE SYNC - INTERNAL
7. MEASUREMENTS MADE WITH RESPECT TO CHASSIS GROUND.

TONE "PL" DECODER WAVEFORMS



EPS 6182 C

TONE "PRIVATE-LINE" DECODER

68P81026E73-F
11/22/77

MAINTAINANCE

a. Recommended Test Equipment

(1) Motorola S1318A Series RF Signal Generator. This solid-state unit provides receiver rf carrier signals.

(2) Motorola SLN6221A "PL" Tone Generator and "Vibrasender" resonant reed on the same frequency as the "Vibrasponder" resonant reed of the decoder. An audio signal generator may be used if it is accurately set to the decoder frequency. However, to obtain the accuracy necessary, the frequency should be adjusted while the signal is measured on a frequency counter.

(3) Motorola Solid-State Oscilloscope for tone signal measurement. Some measurements may be taken with a high impedance ac voltmeter.

(4) Motorola Solid-State DC Multimeter for dc voltage measurements.

b. Performance Tests

A 0.25 microvolt rf carrier signal modulated ±0.5 kHz with PL tone should unsquelch the receiver. This can be checked as follows:

(1) Connect the rf signal generator to the receiver rf input receptacle. Set the signal generator to the receiver carrier frequency, then set the output to minimum.

(2) Modulate the signal generator output ±0.5 kHz with a PL tone of the frequency stamped on the "Vibrasponder" resonant reed. The tone can be generated with a Motorola SLN6221A "PL" Tone Generator and a "Vibrasponder" resonant reed. The "Vibrasender" reed from the PL encoder may be used if it is the proper frequency.

(3) Also modulate the signal generator with an audio tone in the 300 to 3000 Hz range at ±3.3 kHz.

(4) Increase the output of the signal generator until the receiver unsquelches and the audio tone is heard on the speaker. No more than 0.25 microvolt should be required to unsquelch the receiver.

c. Troubleshooting

If the PL decoder does not operate, or operates improperly, the following hints may be helpful in locating the malfunction.

(1) Testing the "Vibrasponder" Resonant Reed

One of the first tests should be a check of the "Vibrasponder" resonant reed. Inject a 340 millivolt rms PL tone of the proper frequenc directly to the primary of the reed. Use an oscilloscope or ac voltmeter to check the output across the secondary of the reed. Approximately 75 millivolts rms should be measured. If the reed is good, continue with other decoder tests.

(2) Decoder Testing

To test the decoder, inject a 1000 microvolt carrier signal into the receiver. Adjust PL modulation for 60 millivolts rms tone signal at the input to the decoder (test point (1) on the schematic diagram and circuit board detail). If the PL tone is injected directly into the decoder for testing, an rf carrier signal should be injecte into the receiver to quiet the receiver noise. Otherwise, noise and PL tone will both be present and will produce erroneous readings.

With 60 millivolts PL tone input, measure signal and dc voltages at various points in the decoder to isolate the trouble. Typical values for a normally operating decoder are given on the schematic diagram. Some waveforms are not sinusoidal and should be measured with an oscilloscope. Most ac voltmeters are calibrated to read accurately only for sinusoidal signals.

If under normal operating conditions, the PL tones are heard with the speaker audio, the high pass filter on the decoder board should be checked.

NOTE

The "PL" decoder can be removed from its normal position in the receiver chassis and plugged on the front or circuitry side of the audio board. Parallel-connected pins have been provided for ease of servicing. Remove the audio board shield for access to these pins.

"DIGITAL PRIVATE-LINE" DECODER

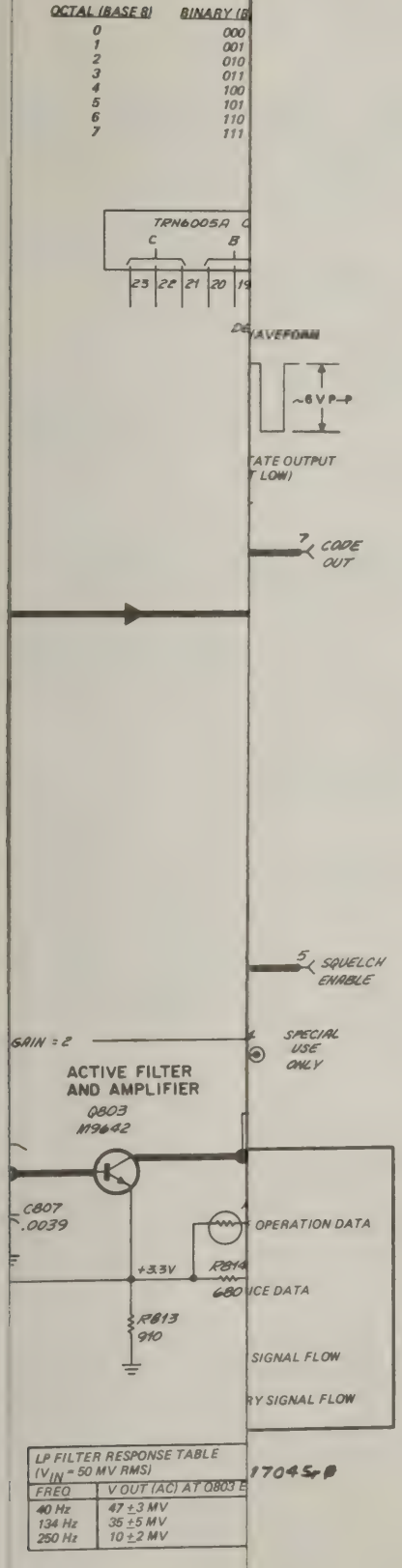
MODEL TLN5729A

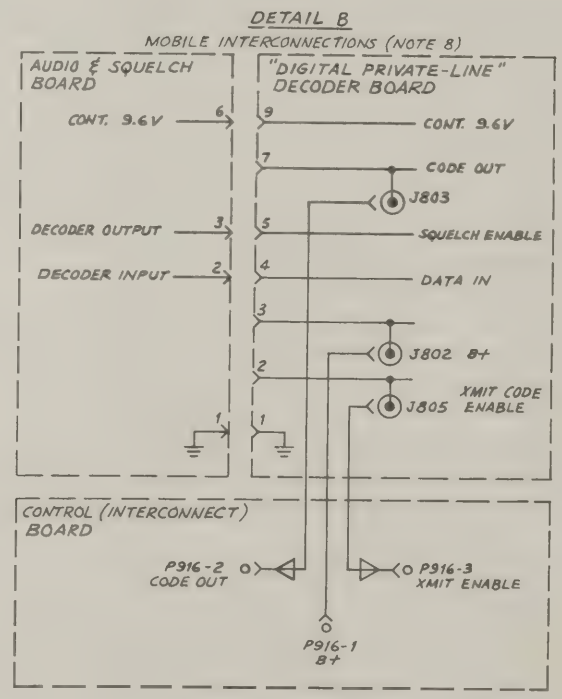
FUNCTION

1. Decodes A 23-bit binary code word to unsquelch the receiver.
2. In radios with simplex "Digital Private-Line" operation, generates a 23-bit binary code word when the transmitter is keyed.

TECHNICAL CHARACTERISTICS

CODE DETERMINING DEVICE	TRN6005A CODE PLUG
CODE FORMAT	23-BIT WORD
CODE FREQUENCY SPECTRUM	11-67 Hz
OUTPUT	SWITCHED 5.3 V DC





REFERENCE SYMBOL	MOTOROLA PART NO.	DESCRIPTION

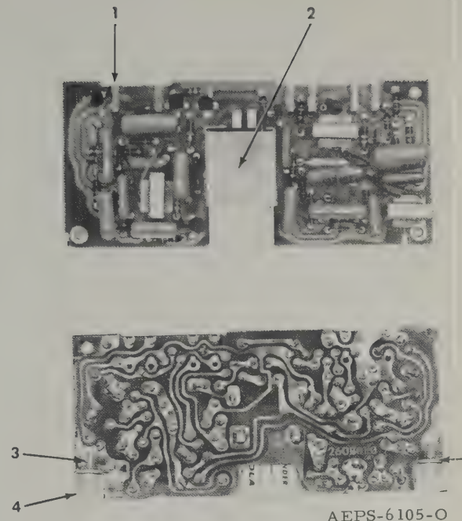
ELECTRICAL PARTS LIST

IMPORTANT

USE ONLY THE FOLLOWING MOTOROLA PART NUMBERS WHEN ORDERING REPLACEMENT PARTS

TRN6002A Tone "Private-Line" Decoder PL-3259-C

		CAPACITOR, fixed: uF ±10%; 50 V; unless otherwise stated
C801	21-82187B38	270 pF
C802	8-82905G32	0.22
C803	8-82905Q08	.033; 100 V
C804	21-82187B39	470pF; 500 V
C805	8-83813H06	0.1; 100 V
C806	8-82905G04	.068; 100 V
C807	8-829b5G01	.01
C808, 809	8-82905G04	.068; 100 V
C810	8-82905G02	.022
C811	8-82905G04	.068; 100 V
C812	23-83214G02	15 ±20%; 25 V
C813	8-82905Q31	0.15
C814	8-83293B10	.033; ±5%
C815	8-83813H16	.022 ±5%
C816	8-82905G30	0.1
C817	8-82095G14	0.1 ±5%; 200 V
C818	21-83406D51	3 pF ±0.25 pF; 500 V
		DIODE: (SEE NOTE I)
CR801, 802	48-83654H01	silicon
		"VIBRASPONDER" RESONANT REED: (SEE NOTE II)
E801	TLN8381A	plug-in unit
		COIL, RF: choke
L801, 802, 803	24-84003A01	6 H
		TRANSISTOR: (SEE NOTE I)
Q801 thru 805	48-869642 or 48-869570	NPN; M9642 NPN; M9570
Q806	48-869643 or 48-869571	PNP; M9643 PNP; M9571
Q807	48-869642 or 48-869570	NPN; M9642 NPN; M9570
		RESISTOR, fixed: ±5%; 1/4 W; unless otherwise stated
R801	6-124C57	2.2k ±10%
R802	6-124C69	6.8k ±10%
R803	6-124A63	3.9k
804, 805	6-124C73	10k ±10%
R806	6-124A89	47k
R807	6-124A41	470
R808	6-124A81	22k
R809	6-124A89	47k
R810	6-124A41	470
R811	6-124A81	22k
R812	6-124C73	10k ±10%
R813	6-124A66	5.1k
R814	6-124A31	180
R815	6-124A65	4.7k
R816	6-124A97	100k
R817	6-124A45	680
R818	6-124C25	100 ±10%
R819	6-124A65	4.7k
R820	6-124A97	100k
R821	6-124A89	47k
R822	6-124A57	2.2k
R823	6-124A13	33
R824	6-124C73	10k ±10%
R825	6-124C57	2.2k ±10%



AEPS-6105-O

MECHANICAL PARTS LIST

TRN6002A Tone "Private-Line" Decoder PL-3261-A

ITEM	MOTOROLA PART NO.	DESCRIPTION
1	9-83011H01	TERMINAL, pin: female; 6 req'd.
2	42-84116B01	SOCKET & CLAMP ASSY
3	3-136905	SCREW, lock: No. 4 x 5/16"; 2 req'd.
4	42-84284B01	RETAINER, Nylon: 2 req'd.
5	7-84223B01	BRACKET, retainer

NOTES:

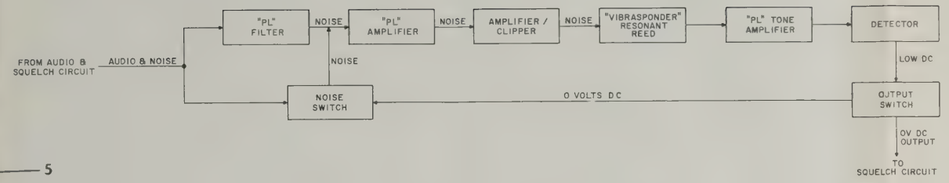
I. For optimum performance, replacement diodes and transistors must be ordered by Motorola part number.

II. The "Vibrasponder" Resonant Reed (Model TLN8381A) is not part of the decoder board. When ordering the complete board, the reed must be ordered separately.

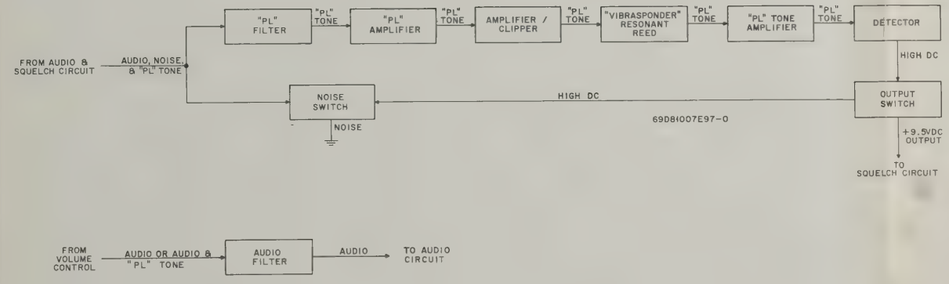
REVISIONS 68P81026E73-E

CHASSIS AND SUFFIX NO.	REF. SYMBOL	CHANGE	LOCATION
TRN6002A	C804	FROM 21-82187B26 .003 uF ±10%; 100 V TO 21-82187B39 470 pF ±10%; 500 V	Q801 BASE
	R803	FROM 6-124C73 10k ±10%; 1/4 W TO 6-124A63 3.9k ±5%; 1/4 W	
	R813	FROM 6-124A65 4.7k ±5%; 1/4 W TO 6-124A66 5.1k ±5%; 1/4 W	Q803 EMITTER

"PL" TONE ABSENT



"PL" TONE PRESENT



MAINTAINANCE

a. Recommended Test Equipment

(1) Motorola S1318A Series RF Signal Generator. This solid-state unit provides receiver rf carrier signals.

(2) Motorola SLN6221A "PL" Tone Generator and "Vibrasender" resonant reed on the same frequency as the "Vibrasponder" resonant reed of the decoder. An audio signal generator may be used if it is accurately set to the decoder frequency. However, to obtain the accuracy necessary, the frequency should be adjusted while the signal is measured on a frequency counter.

(3) Motorola Solid-State Oscilloscope for tone signal measurement. Some measurements may be taken with a high impedance ac voltmeter.

(4) Motorola Solid-State DC Multimeter for dc voltage measurements.

b. Performance Tests

A 0.25 microvolt rf carrier signal modulated ±0.5 kHz with PL tone should unsquelch the receiver. This can be checked as follows:

(1) Connect the rf signal generator to the receiver rf input receptacle. Set the signal generator to the receiver carrier frequency, then set the output to minimum.

(2) Modulate the signal generator output ±0.5 kHz with a PL tone of the frequency stamped on the "Vibrasponder" resonant reed. The tone can be generated with a Motorola SLN6221A "PL" Tone Generator and a "Vibrasponder" resonant reed. The "Vibrasender" reed from the PL encoder may be used if it is the proper frequency.

(3) Also modulate the signal generator with an audio tone in the 300 to 3000 Hz range at ±3.3 kHz.

(4) Increase the output of the signal generator until the receiver unsquelches and the audio tone is heard on the speaker. No more than 0.25 microvolt should be required to unsquelch the receiver.

c. Troubleshooting

If the PL decoder does not operate, or operates improperly, the following hints may be helpful in locating the malfunction.

(1) Testing the "Vibrasponder" Resonant Reed

One of the first tests should be a check of the "Vibrasponder" resonant reed. Inject a 340 millivolt rms PL tone of the proper frequency directly to the primary of the reed. Use an oscilloscope or ac voltmeter to check the output across the secondary of the reed. Approximately 70 millivolts rms should be measured. If the reed is good, continue with other decoder tests.

(2) Decoder Testing

To test the decoder, inject a 1000 microvolt carrier signal into the receiver. Adjust modulation for 60 millivolts rms tone signal at the input to the decoder (test point (1) on the schematic diagram and circuit board detail). Since the PL tone is injected directly into the decoder for testing, an rf carrier signal should be injected into the receiver to quiet the receiver noise. Otherwise, noise and PL tone will both be present and will produce erroneous readings.

With 60 millivolts PL tone input, measure signal and dc voltages at various points in the decoder to isolate the trouble. Typical values for a normally operating decoder are given on the schematic diagram. Some waveforms are not sinusoidal and should be measured with an oscilloscope. Most ac voltmeters are calibrated to read accurately only for sinusoidal signals.

If under normal operating conditions the PL tones are heard with the speaker audio, the high pass filter on the decoder board should be checked.

NOTE

The "PL" decoder can be removed from its normal position in the receiver chassis and plugged on the front or circuitry side of the audio board. Parallel-connected pins have been provided for ease of servicing. Remove the audio board shield for access to these pins.

"DIGITAL PRIVATE-LINE" DECODER

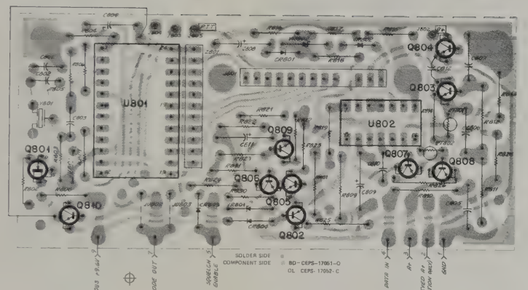
MODEL TLN5729A

PARTS LIST

TLN5729A Decoder Circuit Board PL-3299-A

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION
		CAPACITOR, fixed: uF:
C801	21-83798B01	100 pF ±5%; 200 V
C802	21-82610C22	20 pF ±5%; 200 V
C803	21-82428B46	.0047 ±10%; 100 V
C804	23-82783B08	1.0 ±20%; 35 V
C805	8-82905C39	.023 ±5%; 50 V
C806	8-83813H23	.068 ±5%; 50 V
C807	8-83813H19	.0039 ±5%; 50 V
C808, 811	23-84762H03	10 ±10%; 20 V
C809	23-82783B48	0.68 ±5%; 35 V
C810	21-82187B20	1000 pF ±10%; 100 V
		DIODE: (SEE NOTE)
CR801, 802	48-84616A01	hot carrier
CR803	48-83654H01	silicon
CR804	48-82139G01	germanium
		TRANSISTOR: (SEE NOTE)
Q801	48-869653	field-effect; type M9653
Q802	48-869649	PNP; type M9649
Q803, 809, 810	48-869642	NPN; type M9642
Q804, 805, 806, 807	48-869643	PNP; type M9643
Q808	48-869841	PNP; type M9841
		RESISTOR, fixed: ±10%: 1/4 W: unless otherwise stated
R801, 804, 831	6-124C97	100k
R802, 806	6-124D14	470k
R803	6-124C77	15k
R805	6-124D06	180k
R807, 809	6-124C25	100 ±1/2 W
R808	6-124C37	330
R810, 811, 812	6-13755C64	56.2k ±1%
R813	6-124A48	910 ±5%
R814	6-124A45	680 ±5%
R815	6-124A49	1k ±5%
R816	6-124C43	560
R817, R22, 824, 830	6-124C73	10k
R818	6-124C55	270
R819	6-124C83	27k
R821	6-124A59	2.7k
R823	6-124A57	2.2k ±5%
R825	6-13755C67	5620 ±1%
R826	6-10621C59	4640 ±1%
R827, 829	6-124C83	27k
R828	6-124B10	330k ±5%
		THERMISTOR:
RT801	6-865641	300 ohm @ 25°C
RT802	6-82696B01	10k ohms @ 25°C
		INTEGRATED CIRCUIT: (SEE NOTE)
U801	51-84267A82	M6782
U802	51-84320A55	M2055
		VOLTAGE REGULATOR:
VR801	48-83696E07	Zener type; 6.2 V
VR802	48-82256C03	Zener type; 4.70 V
Y801	48-82003K01	CRYSTAL: resonator; 50.00000 KC
Z801	1-80772B36 or 51-82142K02	RESISTOR NETWORK: pull-up, 10-pin

NOTE: For optimum performance, diodes, transistors and integrated circuits must be ordered by Motorola part numbers.



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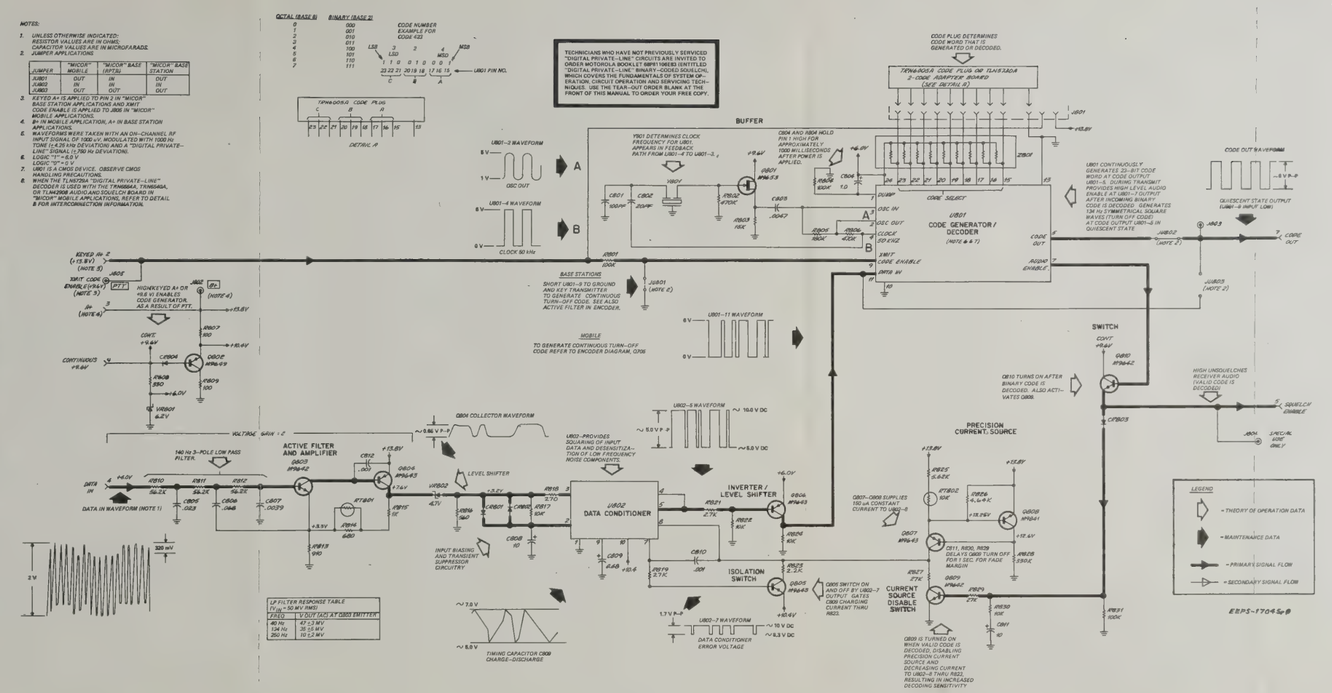
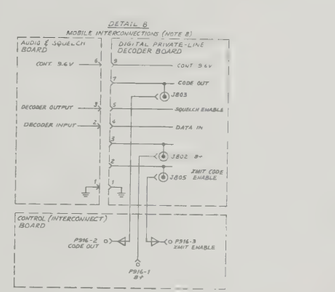

NOTES:
1. UNLESS OTHERWISE INDICATED: RESISTOR VALUES ARE IN OHMS; CAPACITOR VALUES ARE IN MICROFARADS.
2. JUMPER APPLICATIONS:
JUMPER "MICOR" MOBILE "MICOR" BASE (OPTN) "MICOR" BASE STATION
JUM01 OUT IN OUT
JUM02 IN IN IN
JUM03 OUT OUT OUT
3. KEYED A+ IS APPLIED TO PIN 2 IN "MICOR" BASE STATION APPLICATIONS AND XMIT CODE ENABLE IS APPLIED TO J805 IN "MICOR" MOBILE APPLICATIONS.
4. B+ IN MOBILE APPLICATION, A+ IN BASE STATION APPLICATIONS.
5. WAVEFORMS WERE TAKEN WITH AN ON-CHANNEL RF INPUT SIGNAL OF 1000 uV, MODULATED WITH 1000 Hz TONE (±4.25 kHz DEVIATION) AND A "DIGITAL PRIVATE-LINE" CODE (±0.750 kHz DEVIATION).
6. LOGIC "0"= +0.4 V
LOGIC "1"= +2 V
7. U801 IS A CMOS DEVICE. OBSERVE CMOS HANDLING PRECAUTIONS.
8. WHEN THE TLN5729A "DIGITAL PRIVATE-LINE" DECODER IS USED WITH THE TPM8006A, TPM8006B, OR TPM8006C CODE PLUG BOARD IN "MICOR" MOBILE APPLICATIONS, REFER TO DETAIL B FOR INTERCONNECTION INFORMATION.
OCTAL (BASE 8)
BINARY (BASE 2)
CODE NUMBER EXAMPLE FOR CODE 423
LSB
MSB
U801 PIN NO.
TPM8006A CODE PLUG
DETAIL A
TECHNICIANS WHO HAVE NOT PREVIOUSLY SERVICED "DIGITAL PRIVATE-LINE" CIRCUITS ARE INVITED TO ORDER MOTOROLA BOOKLET 68P81098E03 (ENTITLED "DIGITAL PRIVATE-LINE" BINARY-CODED SQUELCH), WHICH COVERS THE FUNDAMENTALS OF SYSTEM OPERATION, THEORY OF OPERATION AND SERVICING TECHNIQUES. USE THE TEAR-OUT ORDER FORM ON THE FRONT OF THIS MANUAL TO ORDER YOUR FREE COPY.
CODE PLUG DETERMINES CODE WORD THAT IS GENERATED OR DECODED.
TPM8006A CODE PLUG OR TLN6730A 2-CODE ADAPTER BOARD (SEE DETAIL B)
BUFFER
U801-3 WAVEFORM
OSC OUT
U801-4 WAVEFORM
CLOCK 60 kHz
Y801 DETERMINES CLOCK FREQUENCY FOR U801. APPEARS IN FEEDBACK PATH FROM U801-4 TO U801-3.
C804 AND R804 HOLD PIN 1 HIGH FOR APPROXIMATELY 100 ms AFTER POWER IS APPLIED.
U801 CONTINUOUSLY GENERATES 23-BIT CODE WORD AT CODE OUTPUT. U801-6 DURING TRANSMIT PROVIDES HIGH LEVEL AUDIO MUTE. U801-7 GOES HIGH AFTER INCOMING BINARY CODE IS DECODED. GENERATES 13H Hz SYMMETRICAL SQUARE WAVES ITURN OFF CODE AT CODE OUTPUT U801-16 IN QUIESCENT STATE
U801 CODE GENERATOR / DECODER (NOTE 4 & 7)
CODE SELECT
OSC IN
OSC OUT
CLOCK (5V EXC)
XMIT CODE ENABLE
DATA IN
CODE OUT
AUDIO ENABLE
CODE OUT WAVEFORM
QUIESCENT STATE OUTPUT (U801-6 INPUT LOW)
J802 (NOTE 2)
J803
J803 (NOTE 2)
J805 (NOTE 2)
BASE STATIONS
SHORT U801-9 TO GROUND AND KEY TRANSMITTER TO GENERATE CONTINUOUS TURN-OFF CODE. SEE ALSO ACTIVE FILTER IN ENCODER.
MOBILE
TO GENERATE CONTINUOUS TURN-OFF CODE REFER TO ENCODER DIAGRAM, CD16
U801-11 WAVEFORM
U802-5 WAVEFORM
U802-PROVIDES SQUARING OF INPUT DATA AND DESENSITIZATION OF LOW FREQUENCY NOISE COMPONENTS.
Q804 COLLECTOR WAVEFORM
KEYED B+ (+13.8V) (NOTE 5)
XMIT CODE ENABLE (+5V) (NOTE 3)
HIGH=KEYED A+ OR +5.6 V: ENABLES CODE GENERATION AS A RESULT OF PTT.
CONTINUOUS +5.6V
VOLTAGE GAIN = 2
ACTIVE FILTER AND AMPLIFIER
140 Hz 3-POLE LOW PASS FILTER
DATA IN
DATA IN WAVEFORM (NOTE 1)
LEVEL SHIFTER
INPUT BIASING AND TRANSIENT SUPPRESSOR CIRCUITRY
U802 DATA CONDITIONER
INVERTER / LEVEL SHIFTER
ISOLATION SWITCH
Q805 SWITCH ON AND OFF BY U802-7 OUTPUT. GATES C808 CHARGING CURRENT THRU R823.
U802-7 WAVEFORM
DATA CONDITIONER ERROR VOLTAGE
CURRENT SOURCE DISABLE SWITCH
Q805 IS TURNED ON WHEN VALID CODE IS DECODED, DISABLING PRECISION CURRENT SOURCE AND DECREASING CURRENT TO U802-8 THRU R823, RESULTING IN INCREASED DECODING SENSITIVITY.
PRECISION CURRENT SOURCE
Q807-Q808 SUPPLIES 150 uA CONSTANT CURRENT TO U802-8
C811, R830, R828 DELAYS Q808 TURN OFF FOR 1 SEC. FOR FADE MARGIN
Q810 TURNS ON AFTER BINARY CODE IS DECODED. ALSO ACTIVATES Q806.
SWITCH
HIGH UNSQUELCHES RECEIVER AUDIO (VALID CODE IS DECODED)
SQUELCH ENABLE
J804 SPEC/AC WIRE ONLY
LEGEND
= THEORY OF OPERATION DATA
= MAINTENANCE DATA
= PRIMARY SIGNAL FLOW
= SECONDARY SIGNAL FLOW
EDPS-17045-B
LP FILTER RESPONSE TABLE
(V in = 50 mV RMS)
FREQ V OUT (DC) AT Q805 EMITTER
40 Hz 4.7 ±3 MV
134 Hz 35 ±5 MV
250 Hz 10 ±2 MV
TIMING CAPACITOR C808 CHARGE-DISCHARGE

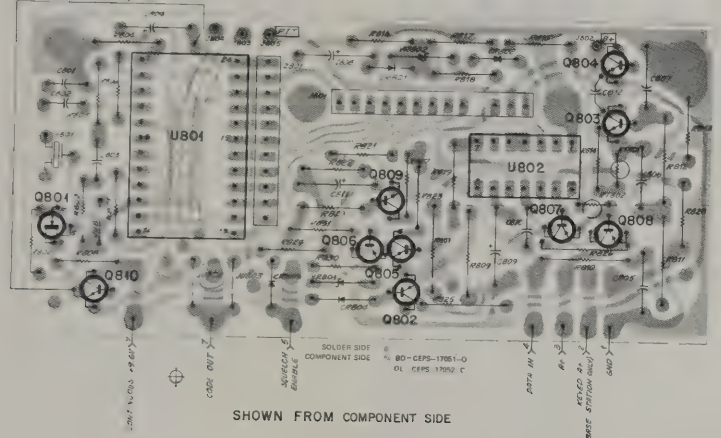
TECHNICAL CHARACTERISTICS

CODE DETERMINING DEVICE	TRN6005A CODE PLUG
CODE FORMAT	23-BIT WORD
CODE FREQUENCY SPECTRUM	11-67 Hz
OUTPUT	SWITCHED 5.3 V DC

FUNCTION

1. Decodes A 23-bit binary code word to unsquelch the receiver.
2. In radios with simplex "Digital Private-Line" operation, generates a 23-bit binary code word when the transmitter is keyed.





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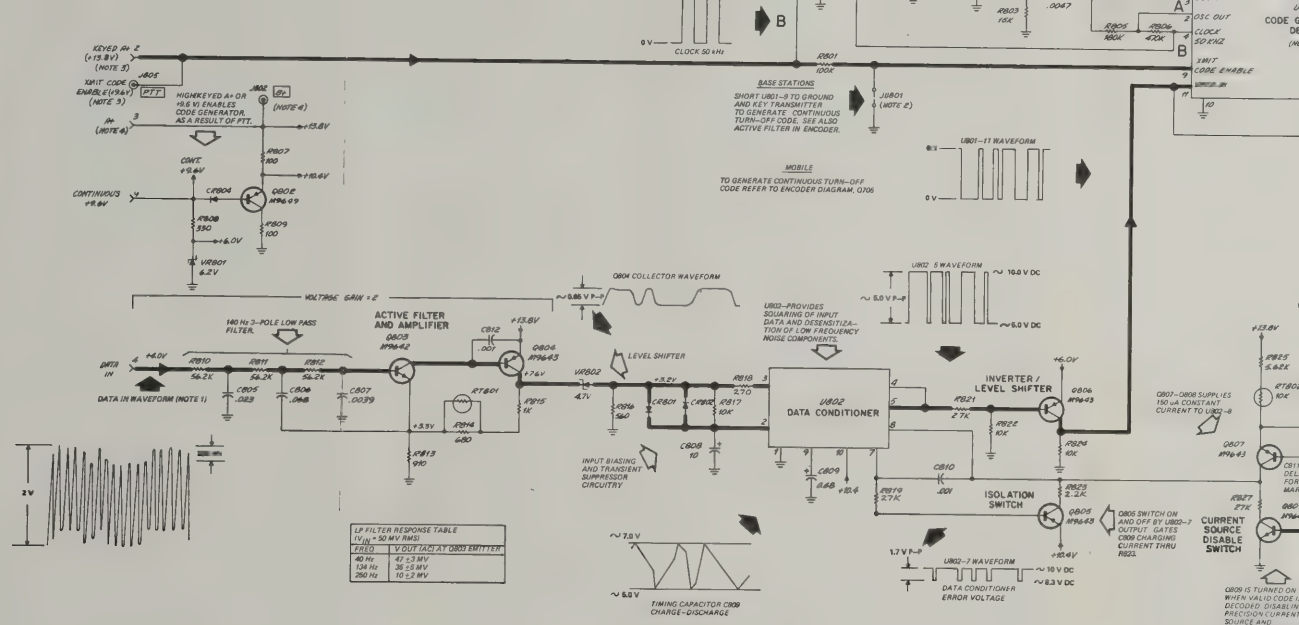


RECEIVER INTERCONNECT BOARD

FUNCTION

Interconnects various receiver circuit boards to the unified chassis interconnect board. Model differences are primarily rf filtering.

NOTES

961. JU960 IS CUT FOR DIGITAL "PL" REPEATER STATIONS AND FULL DUPLEX DIGITAL "PL" BASE STATIONS.

962. SEE FOLLOWING TABLE FOR FILTERING COMPONENT USAGE BY MODEL. MODEL TLN5648A DOES NOT USE ANY FILTERING COMPONENTS, BUT INCORPORATES "THRU" PLATING INSTEAD. (PLATING RUNS AND FILTERING COMPONENTS DO NOT EXIST SIMULTANEOUSLY). SEE PARTS LIST FOR COMPONENT VALUES AND PART NUMBERS:

TLN5648A	TLN5648A	TLN5655A	TRN6196A	TRN6308A
C1 THRU C80	NOT USED	C8, C10–C14, C19–C25, C27, C30, C35, C40–C44, C49–C55, C57, C80	C1 THRU C80	C1 THRU C80
L5, L10, L13, L18–L30	NOT USED	L5, L10–L14, L18–L26, L27, L30	L1–L30	L1–L30

963. JU951 IS CONNECTED IN SINGLE–FREQUENCY RECEIVERS ONLY. RECEIVER CHANNEL ELEMENTIS ALWAYS ACTIVATED.

964. AN OPTIONAL MODE OF RECEIVER OPERATION KNOWN AS "AND SQUELCH" CAN BE ADDED WHEN DESIRABLE. THIS FEATURE PROVIDES "VARIABLE PL SENSITIVITY" (PL–CODED SQUELCH PLUS ADJUSTABLE NOISE–ACTIVATED (CARRIER) SQUELCH). IN THIS MODE, THE RECEIVER AUDIO CHANNEL IS ACTIVATED WHEN A PL CODE IS RECEIVED AND THE CARRIER SQUELCH THRESHOLD LEVEL IS EXCEEDED. SINCE THE CARRIER (NOISE–ACTIVATED) SQUELCH CIRCUIT SENSITIVITY IS ADJUSTABLE, AND SINCEIT IS ONE OF THE CONTROLLING FACTORS IN THE SQUELCHING OF RECEIVER AUDIO, THE OPERATION CAN BE APTLY DESCRIBED AS "VARIABLE PL SENSITIVITY". THUS "AND SQUELCH" DENOTES BOTH PL–CODED SQUELCH AND CARRIER SQUELCH OPERATING SIMULTANEOUSLY. CR956, CR960, & R962 ARE USED AND JUMPERS JU956 AND JU957 ARE OMITTED FOR "AND" SQUELCH OPERATION (JU204 ON AUDIO &S QUELCH BOARD MUST ALSO BE CUT) AND ARE NOT PART OF THE RECEIVER INTERCONNECT BOARD.

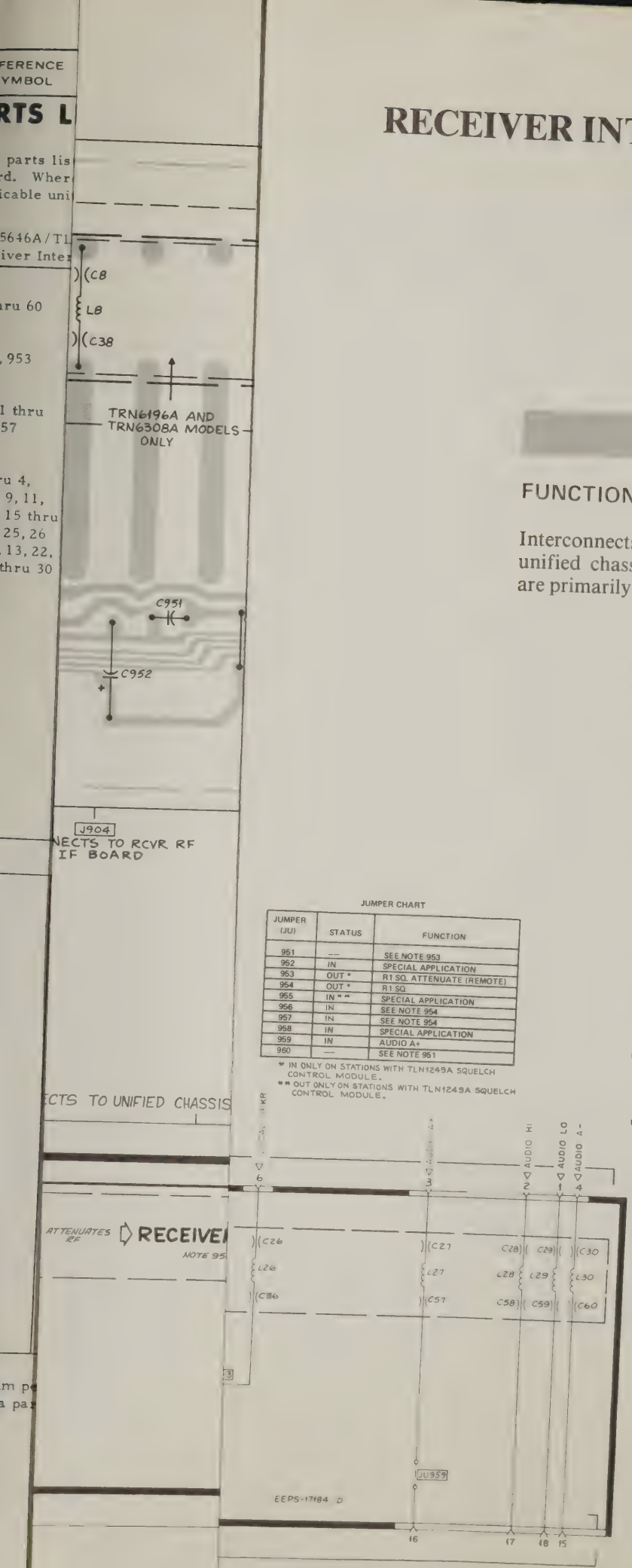
965. TWO–RCVR STATIONS USE THE TLN5655A VERSION BOARD TO INTERCONNECT THE 2ND RCVR TO THE UNIFIED CHASSIS INTERCONNECT BOARD. THIS VERSION BOARD DOES NOT PLUG DIRECTLY INTO THE UNIFIED CHASSIS BOARD BUT RATHER IS INTERCONNECTED VIA P6. P6 IS CONNECTED TO THE RCVR INTERCONNECT BOARD J AS DETAILED IN THE 2ND RCVR CONNECTION TABLE.

966. CR967 REMOVED ON TLN6196A FOR REPEAT OR DUPLEX OPERATION.

JUMPER CHART

JUMPER (JU)	STATUS	FUNCTION
951	—	SEE NOTE 953
952	IN	SPECIAL APPLICATION
953	OUT *	R1 SQ. ATTENUATE (REMOTE)
954	OUT *	R1 SQ.
955	IN * *	SPECIAL APPLICATION
956	IN	SEE NOTE 954
957	IN	SEE NOTE 954
958	IN	SPECIAL APPLICATION
959	IN	AUDIO A+
960	—	SEE NOTE 951

* IN ONLY ON STATIONS WITH TLN1249A SQUELCH CONTROL MODULE.
* * OUT ONLY ON STATIONS WITH TLN1249A SQUELCH CONTROL MODULE.



HANDLING PRECAUTIONS FOR CMOS INTEGRATED CIRCUITS

Many of the integrated circuit devices used in communications equipment are of the CMOS (Complementary Metal Oxide Semiconductor) type. Because of their high open circuit impedance, CMOS ICs are vulnerable to damage from static charges. Care must be taken in handling, shipping, and servicing them and the assemblies in which they are used.

Even though protection devices are provided in CMOS IC inputs, the protection is effective only against overvoltage in the hundreds of volts range such as are encountered in an operating system. In a system, circuit elements distribute static charges and load the CMOS circuits, decreasing the chance of damage. However, CMOS circuits can be damaged by improper handling of the modules even in a system.

To avoid damage to circuits, observe the following handling, shipping, and servicing precautions:

(1) Prior to and while servicing a circuit module, particularly after moving within the service area, momentarily touch both hands to a bare metal earth grounded surface. This will discharge any static charge which may have accumulated on the person doing the servicing.

(2) Whenever possible avoid touching any electrically conductive parts of the circuit module with your hands.

(3) Normally, circuit modules can be inserted or removed with power applied to the unit. However, check the INSTALLATION and MAINTENANCE sections of the manual as well as the module schematic diagram to insure there are no objections to this practice.

(4) When servicing a circuit module, avoid carpeted areas, dry environments, and certain types of clothing (silk, nylon, etc.) because they contribute to static buildup.

(5) All electrically powered test equipment should be grounded. Apply the ground lead from the test equipment to the circuit module before connecting the test probe. Similarly, disconnect the test probe prior to removing the ground lead.

(6) If a circuit module is removed from the system, it is desirable to lay it on a conductive surface (such as a sheet of aluminum foil) which is connected to ground through a resistance of approximately 100k.

WARNING

If the aluminum foil is connected directly to ground, be cautious of possible electrical shock from contacting the foil at the same time as other electrical circuits.

(7) When soldering, be sure the soldering iron is grounded.

(8) Prior to connecting jumpers, replacing circuit components, or touching CMOS pins (if this becomes necessary in the replacement of an integrated circuit device), be sure to discharge any static buildup as described in procedure 1. Since voltage differences can exist across the human body, it is recommended that only one hand be used if it is necessary to touch pins on the CMOS device and associated board wiring.

(9) When replacing a CMOS integrated circuit device, leave the device in its metal rail container or conductive foam until it is to be inserted into the printed circuit module.

(10) All low impedance test equipment (such as pulse generators, etc.) should be connected to CMOS device inputs after power is applied to the CMOS circuitry. Similarly, such low impedance equipment should be disconnected before power is turned off.

(11) Replacement modules shipped separately from the factory will be packaged in a conductive material. Any modules being transported from one area to another should be wrapped in a similar material (aluminum foil may be used). NEVER USE NONCONDUCTIVE MATERIAL for packaging these modules.

EPS-18293-O

"DIGITAL PRIVATE-LINE" DECODER BOARD TROUBLESHOOTING CHART

NOTES:

1. To obtain a test code for the following procedure apply a carrier frequency signal to the receiver rf input from an rf signal generator modulated by the code output of a Motorola SLN6413A "Digital Private-Line" Test Set. Be sure the signal generator is able to accept very low frequency modulation (less than ±5 Hz).
2. Before you replace U801, use the following procedure to verify that U801 is malfunctioning:
   a. Connect U801-11 to the code input of a Motorola SLN6413A "Digital Private-Line" Test Set.
   b. Apply a carrier-frequency signal to the receiver rf input from a signal generator that is modulated by the code output of the test set.

   If proper decode is indicated, U801 must be replaced. If U801 must be replaced, refer to the CMOS handling precautions.

SYMPTOM	PROBABLE CAUSE	ACTION
No decode, but received audio is good when PL is disabled.	1. Audio squelch is malfunctioning.	Remove the decoder board. Apply +9.6 V at P201-3 on audio & squelch board. If audio is not enabled, troubleshoot audio & squelch circuits.
	2. No 50 kHz clock	Check U801-4 for 50 kHz clock pulses. Rise time must be ≤750 n sec.
	3. Audio enable switch is malfunctioning.	If U801-7 is high, but circuit board pin 5 is low when receiving code, replace Q810.
	4. Dump pin U801-1 is always high.	Check U801-1 should always be 0 V.
	5. Wrong or bad code plug.	Replace with a known good code plug. Check U801-15 through U801-23 for proper octal code.
	6. No data into U801.	Check U801-11 for 0 - 6 V pulses. If pulses are not present, check Q806 and U802 operation.
	7. Transmit code enable input is high.	Ground U801-9. If a received code is properly decoded, check for a malfunction in the delayed transmit enable circuit on the encoder board.
	8. U801 has an internal malfunction.	If, after checking causes 1 through 7, the cause of the problem has not been isolated, replace U801. CAUTION U801 is a CMOS device and may be damaged by improper handling. Refer to the CMOS handling precautions in this instruction section.
Excessive decoder falsing when monitoring an inactive channel (noise falsing).	1. Precision current source is low or inoperative.	Measure the dc voltages in the precision current source circuits. Current to U801-8 = (V_{BE} of Q808) (R825 + R826 +RT802)/ R826 (R825 + RT802)
	2. Current source disable switch is always on.	Check for 8 - 10 V at Q809 collector. If Q809 collector is 0 V, replace Q809.
	3. Improper 140 Hz low pass filter response.	Check dc voltages in filter circuit. Check the filter frequency response. Measured at Q803 emitter, the filter response should be -1.0 to -4.0 dB at 134 Hz and -12 to -15 dB at 250 Hz with 50 mV rms signal at decoder input.
	4. U802 supply voltage is too high.	Check U802-10 for +10.4 V ±0.2 V dc. If voltage is high, troubleshoot the +10.4 V regulator on the decoder board.
Excessive squelch tails (approx. 500 msec noise burst) at ends of received transmissions	1. Turn-off code not being transmitted by other radio unit.	Monitor circuit board pin 4 (DATA IN) for presence of turn-off code at ends of transmissions.
	2. U802 lock-in malfunction	Ground Q809 collector. With a 300 mV p-p signal at circuit board pin 4 (DATA IN), the waveform at U802-4 should be locked in to the input signal up to at least 175 Hz. If proper lock-in does not occur, replace C809, then check lock-in again. If lock-in is still bad, replace U802.
	3. U801 turn-off code detector is malfunctioning.	Check U801 (Note 2).
Poor detector sensitivity in poor quieting conditions	1. Improper 140 Hz low pass filter response response.	Check dc voltages in filter circuit. Check the filter frequency response; measured at Q803 emitter, the filter response should be -1.0 to -4.0 dB at 134 Hz and -12 to -15 dB at 250 Hz with 50 mV rms signal at decoder input.
	2. Precision current source supplying too much current to U802-8.	Measure the dc voltages in the current source circuits. Current to U802-8 = (V_{BE} of Q808) (R825 + R826 + RT802) R826 (R825 + RT802)
	3. Current source disable switch inoperative.	While detecting a valid code, check Q809 collector for 0 V dc. If 8-10 V is present, replace Q809.
Occassional squelch tail about 1 second after the end of a transmission from another radio	Current source disable switch is staying on too long.	Check Q809 collector. Q809 collector should go from 0 V dc to 8-10 V within 1.5 seconds after loss of audio squelch disable.

EPS-17705-C

REFERENCE SYMBOL	MOTOROLA PART NO	DESCRIPTION

PARTS LIST

NOTE

This parts list covers five models of the Receiver Interconnect Board. Where differences exist, the model number of the applicable unit is given in the Description column.

TLN5646A/TLN5648A/TLN5655A/TRN6196A/TRN6308A
Receiver Interconnect Board — PL-3435-B

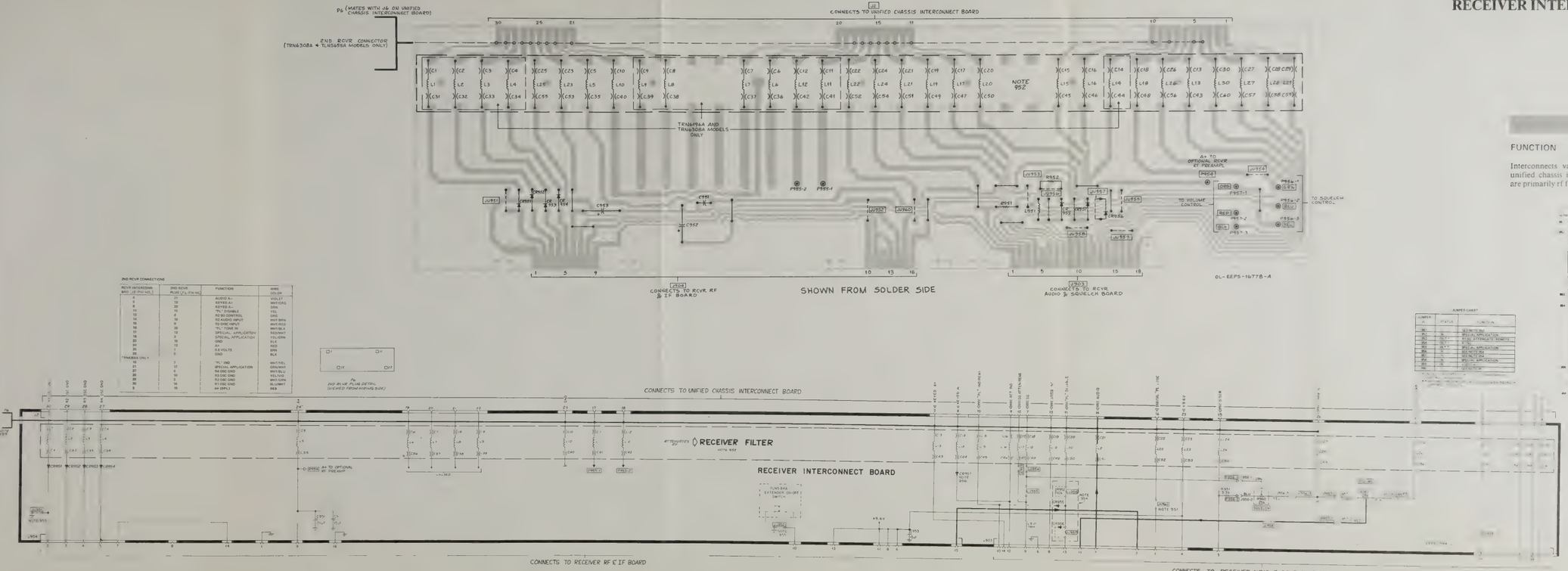
1 thru 3	21-8a1219	CAPACITOR, fixed: 1000 pF +100-0%; 500 V (TRN6196A & TRN6308A)
951	21-82428B59	.01 uF +80-20%; 200 V
C952, 953	23-84762H09	15 uF ±20%; 20 V
CR951 thru 954, 957	23-84762H09	DIODE: (SEE NOTE) silicon
L1 thru 4, 6 thru 9, 11, 12, 14, 15 thru 24, 26, 28, 29	24-83961B01	COIL, rf: 3 turns; coded brown
L5, 10, 13, 22, 25, 27 thru 30	24-83977B01	1-1/2 turns
L401	24-82549D03	1000 uH
	--	CONNECTOR, plug: (TLN5655A) includes:
	14-8455xB01	HOUSING, connector
	9-84151B03	CONTACT, receptacle: 14 req'd.
	--	(TRN6308A) includes:
	14-8455xB01	HOUSING, connector
	9-84151B03	CONTACT, receptacle: 20 req'd.
R951	6-124Cb1	RESISTOR, fixed: 3.3k ±10%; 1/4 W

NOTE:
For optimum performance, replacement diodes must be ordered by Motorola part number.

NON-REFERENCED ITEMS

	7-82626K01	BRACKET, filter
	14-82621K01	INSULATOR (TLN5648A & TLN5655)
	1-80775B75	COVER ASSEMBLY, filter (TLN5646A, TLN5655A, TRN6196A & TRN6308A) includes:
	15-82173K01	COVER, filter
	3-138162	SCREW, tapping: 4-40 x 3/8"; 5 used (TLN5646A, TRN6196A & TRN6308A)
	3-139495	SCREW, tapping: 6-20 x 5/16" 8 used (TLN5646A, TLN5648A, TRN6196A & TRN6308A)
	42-84284B01	RETAINER, screw: 5 used (TLN5646A, TRN6196A & TRN6308A)
	3-139495	SCREW, tapping: 6-20 x 5/16" 7 used (TLN5655A)
	42-82143C02	CLAMP, cable: 1/4" ID; 2 used (TLN5655A)
	42-82143C02	CLAMP, cable: 1/4" ID (TRN6308A)
	42-82143C03	CLAMP, cable: 1/8" ID (TLN5655A & TRN6308A)

RECEIVER INTERCONNECT BOARD


P6 (MATES WITH J6 ON UNIFIED CHASSIS INTERCONNECT BOARD)
2ND RCVR CONNECTOR (TRN6308A & TLN5655A MODELS ONLY)
J1
CONNECTS TO UNIFIED CHASSIS INTERCONNECT BOARD
TRN6196A AND TRN6308A MODELS ONLY
NOTE 952
A+ TO OPTIONAL RCVR EE PROM/PL
TO VOLUME CONTROL
TO SQUELCH CONTROL
J1004
CONNECTS TO RCVR RF & IF BOARD
SHOWN FROM SOLDER SIDE
J1003
CONNECTS TO RCVR AUDIO & SQUELCH BOARD
OL-EEPS-1677B-A
2ND RCVR CONNECTIONS
RECEIVER FILTER
RECEIVER INTERCONNECT BOARD
TLN5646 EXTENDER ON-OFF SWITCH
CONNECTS TO UNIFIED CHASSIS INTERCONNECT BOARD
CONNECTS TO RECEIVER RF & IF BOARD
CONNECTS TO RECEIVER AUDIO & SQUELCH BOARD

FUNCTION

Interconnects various receiver circuit boards to the unified chassis interconnect board. Model differences are primarily rf filtering.

CONDENSED CONTENTS

TAB 1

DESCRIPTION
INSTALLATION
MAINTENANCE

TAB 2

EXCITER/1ST BANDPASS FILTER
TRIPLER AND DOUBLER
INTERMEDIATE POWER AMPLIFIER
DIRECTIONAL COUPLER
POWER CONTROL BOARD
FINAL POWER AMPLIFIER
TRANSMITTER INTERCONNECT BOARD
TONE "PL" ENCODER
"DIGITAL PL" ENCODER (SIMPLEX)
"DIGITAL PL" ENCODER (DUPLEX)

TAB 3

RF AND I–F DECK
AUDIO AND SQUELCH BOARD
AUDIO POWER AMPLIFIER
TONE "PL" DECODER
"DIGITAL PL" DECODER

TAB 4

HIGH VOLTAGE POWER SUPPLY
LOW VOLTAGE POWER SUPPLY

HIGH VOLTAGE POWER SUPPLY

MODEL TPN1147A

1. DESCRIPTION

This power supply produces various dc voltages which are used to operate a vacuum tube type high power rf amplifier for the transmitter and ac voltages which are used to drive the companion TPN1148A Low Voltage Power Supply. The voltages produced for operation of the power amplifier are:

-- 1500 V dc plate voltage
-- 50 V dc bias voltage

The power supply uses a constant voltage ferroresonant transformer to provide the basic operating voltages to the rectification circuits. This transformer maintains the output voltages within ±3% with a ±20% change in input line voltage.

CAUTION

The input power must maintain an operating frequency to within ±3 Hz in order to keep within the regulation characteristics of the transformer.

The power supply contains an interlock protection circuit which prevents high voltages from being produced unless the station interlocks are enabled (closed).

WARNING - HIGH VOLTAGE

Extreme care must be exercised when servicing this equipment. Do not defeat interlock switches. It is a good practice to assume that HIGH VOLTAGES are present at all times, even after the ac input power is removed from the station.

2. FUNCTIONAL OPERATION

The ac input to the power supply is routed through TB1 and F1 to T1 and T2. Two voltages are produced by half-wave rectification; the +50 V dc PA tube bias and the station safety interlock voltage. The interlock voltage is routed through the interlock switches and back to the power supply to energize K1. AC power is applied through the closed contacts of K1 to T1. The multiple winding secondary of T1 provides voltages to power the full wave rectifier network for the +1500 V dc and the companion low voltage power supply.

The filament control input to the filament regulator board through TB1-4 is enabled as follows. The transmitter turn-on switched A-function (C3) is applied through Q57 to Schmitt trigger Q56 and Q55. The Schmitt Trigger sets bistable multivibrator Q54 and Q53 so that Q53 is cut off and Q54 is turned on. The high at the collector of Q53 causes switch Q52 to turn on and create a current path through TB1-4 to the filament control input (see paragraph 2.3 in section 68P81031E53.

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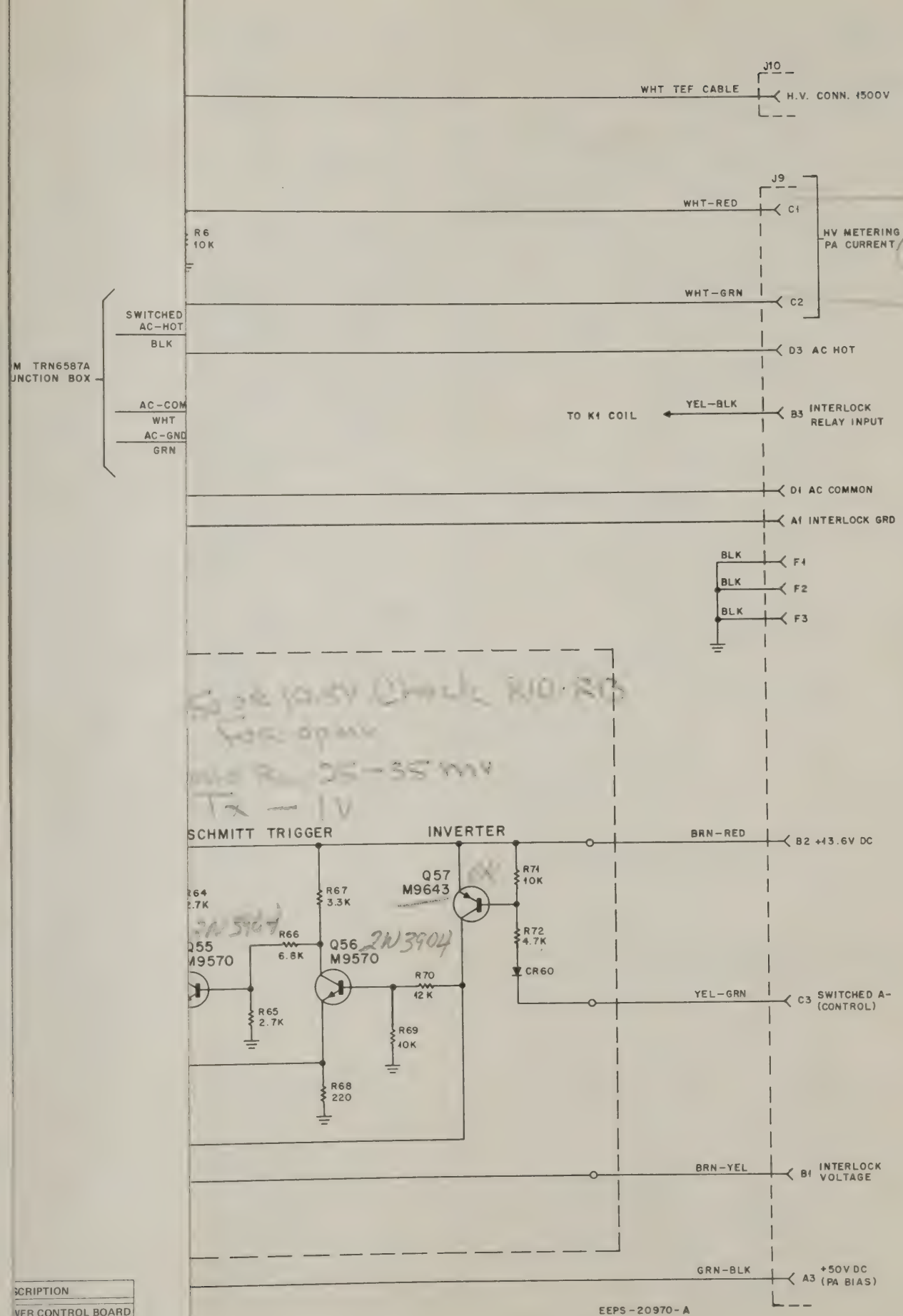
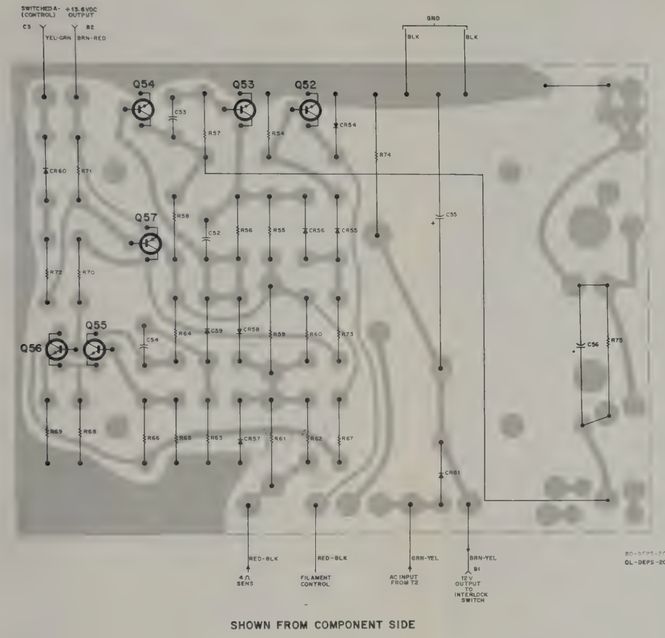


SCRIPTION
VER CONTROL BOARD
ASSIS KIT
BLE KIT

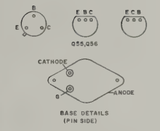
EPS-22427-O

TPN1147A High Voltage Power Supply
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-20971-B
3/30/78-NPC

HIGH VOLTAGE POWER SUPPLY



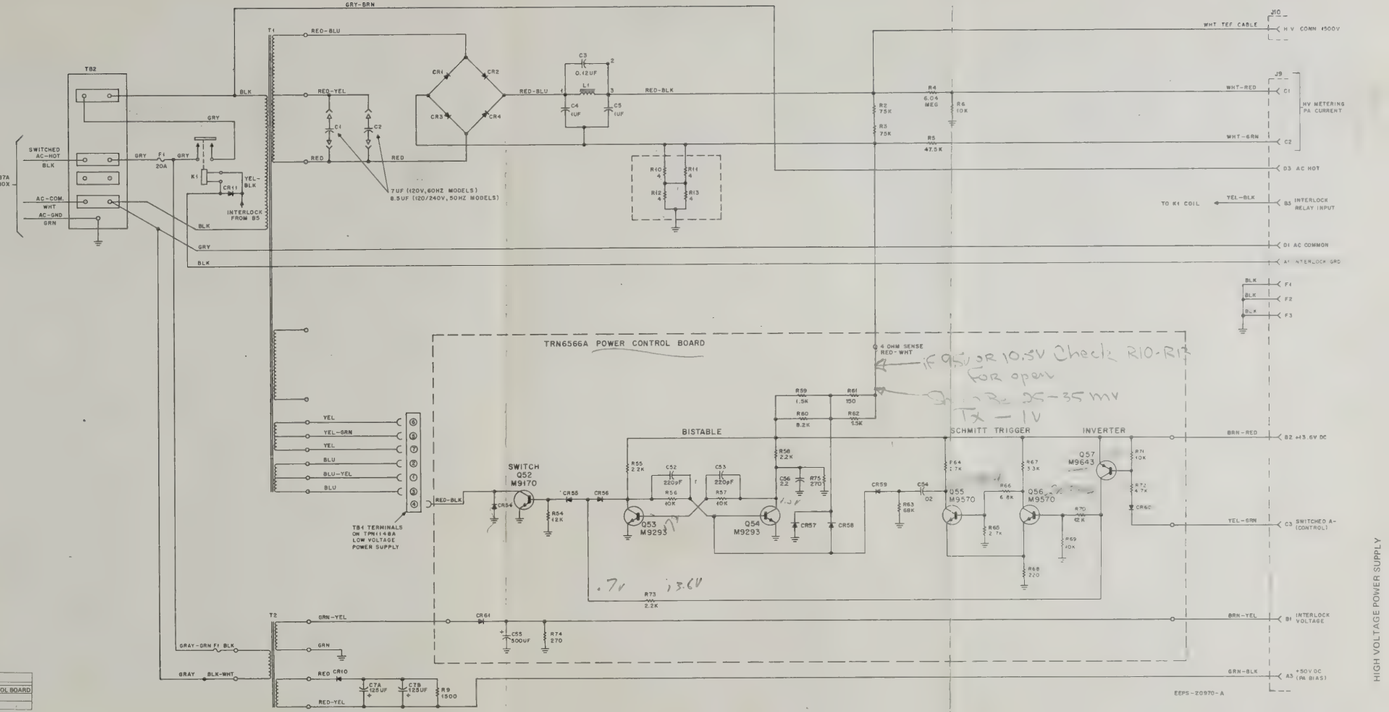
SHOWN FROM COMPONENT SIDE



MODEL CHART

MODEL	SUFFIX	ITEM	SUFFIX	DESCRIPTION
TPN1147A		TRN6566A	1	POWER CONTROL BOARD
		TRN6567A		CHASSIS KIT
		TKN6840A		CABLE KIT

EPS-22427-O



TPN1147A High Voltage Power Supply
Schematic Diagram and Circuit Board Detail
Motorola No. PEPS-20971-B
3/30/78-NPC

HIGH VOLTAGE POWER SUPPLY

LOW VOLTAGE POWER SUPPLY

MODEL TPN1148A

Model Complement

MODEL	DESCRIPTION
TLN5122A	9.6 and 13.6 Volt Regulator Board
TRN6568A	Filament Regulator Board
TKN6703A	Cable, L.V. Power Supply
TKN6846A	Chassis Cable, L.V. Power Supply
TRN6569A	Chassis and Hardware Kit

1. DESCRIPTION

1.1 This power supply provides the following output voltages:

-- regulated 6.3 volts dc for PA tube filaments.

-- regulated 9.6 and 13.6 volts dc for operation of the solid-state circuitry contained within the transmitter.

-- unregulated 13.6 volts dc for the oscillator oven.

1.2 The low voltage power supply obtains its ac input from the companion high voltage power supply which provides a relatively constant input voltage (±3%) with a source voltage change of ±20%. Transistorized regulator circuits provide highly regulated dc output voltages.

2. THEORY OF OPERATION

2.1 INPUT CIRCUITRY (Refer to diagram PEPS-20976)

Diodes CR1 and CR2 provide full wave rectification of the nominal 14.5 volt ac input applied to TB1-6 and 7. The resulting dc voltage is applied through TB1-5 and fed through a double pi type LC filter to the 6.3 volt regulator on the filament regulator board, and to the 9.6 volt regulator. Diodes CR3 and CR4 provide full wave rectification of the nominal 18.5 volt ac input applied to TB1-2 and 3. The resulting dc voltage, applied through TB1-1, is capacitively filtered and applied to the 13.6 volt regulator. Each regulator circuit is protected from drawing excessive current by a fuse in its input.

2.2 9.6 V AND 13.6 V REGULATORS

2.2.1 General

Except for the voltages involved, the operation of the 9.6 volt and 13.6 volt regulators is the same. The operation of the 9.6 volt regulator is described in the following paragraphs (refer to diagram PEPS-20976).

2.2.2 9.6 V Regulator

2.2.2.1 Output

The 9.6 volt output is derived from a series regulator circuit that uses a higher level A+ as its source. An output voltage sensing circuit regulates the amount of current that is allowed to pass through the series regulator, thus controlling the voltage across the load.

2.2.2.2 Voltage Regulation

Transistors Q1, Q3, and Q4 form the voltage regulating circuit. Regulation is achieved by changing the amount of current to flow through the base of Q2. If the output voltage

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increases, the Q2 base current is decreased, and vice versa. The regulator output voltage is developed across R8 and R9. The voltage developed across R9 reflects all fluctuations of the output load voltage and is applied to the base of Q4. Since the emitter of Q4 is held to 8.2 volts by Zener diode VR1, Q4 conducts in response to the output load voltage fluctuations. When the output load voltage is 9.6 volts, Q4 conducts at a specific level which fixes its collector voltage to a specific level. This voltage level determines the drive to the base of Q3, which determines the drive to the base of Q2. Q1 is a constant current source for the collector of Q4 and the base of Q3. Current through Q1 is held constant because of the voltage drop across CR5 and CR6 which maintains a constant base to emitter bias voltage.

If the 9.6 volt output increases, the Q4 base voltage increases and Q4 conducts harder which causes its collector voltage to decrease. This causes Q3 to conduct less and Q3 collector to draw less current. This decreases the amount of base current Q2 can draw, thus causing the emitter to collector impedance across Q2 to increase. The voltage dropped across Q2 increases, decreasing the output load voltage to normal. If the 9.6 volt output decreases, the above action reverses to bring the output voltage back up to the normal level. For the 9.6 volt regulator, the output voltage may range between 9.0 and 10.2 volts dc. For the 13.6 volt regulator, the output voltage may range between 12.9 and 14.5 volts dc.

2.3 FILAMENT REGULATOR CIRCUIT

The 6.3 volt filament regulator operates in a manner similar to that described for the 9.6 and 13.6 volt regulators (refer to diagram PEPS-20980). This regulator uses an additional amplifier transistor (Q52) to increase the drive voltage available to driver stage Q53. In addition, Q53 is changed to a collector follower instead of an emitter follower. This reduces the minimum voltage drop permitted across series pass stage Q54. Q55 operates as a reference amplifier for the regulating circuitry and its operating point is adjustable by filament voltage control R59.

The 6.3 volt filament regulator employs a filament voltage control to protect the filament during transmission. R59 and R60 provide a voltage divider network used to set the filament voltage. Under unkeyed conditions, the filament control input (from the high voltage power supply) is high, turning Q56 on and removing R60 from the circuit. With Q56 on, the drive to Q55 through R59 is reduced, pulling the collector of Q55 high and increasing the filament voltage to 6.3 volts. When the transmitter is keyed, the filament control input goes low, turning Q56 off. The high impedance of Q56 collector places R60 in the circuit. R60 may now be set to increase the drive to Q55, lowering its collector voltage and reducing the filament voltage to approximately 5.0 volts.

The filament control input also controls the bias output control. A low input (transmitter keyed) will turn on Q57, providing approximately 10 volts at the bias output control.

2.4 TRANSMITTER INHIBIT CIRCUIT

Upon initial turn-on, the transmitter inhibit circuit disables the transmitter for approximately 68 seconds, allowing the tube filaments in the final power amplifier to warm up (refer to diagram PEPS-20980).

When power is applied to the station, three things happen:

-- 60 Hz signal is applied to IC52A.
-- The counter is reset (pin 11) and output pin 2 goes to logic 0.
-- The 6.3 volt output from the filament regulator board is inverted (Q58) and applied to pins 12 and 13 on IC52D.

The high output from IC52D is fed to IC52C and IC52B, and the high output from IC52B fed back to IC52A. IC51 is now enabled and will count for approximately 68 seconds. When the counter output goes high, the output to IC52B goes low. This low is fed back to pin 1 on IC52A, locking the counter in this state. The high counter output is also fed to IC52C. The resulting low turns Q60 off, enabling the transmitter.

C62 provides a spike pulse to reset the counter when power is initially applied. C63 provides transient protection for the low power CMOS logic chips.

NOTE

Low power CMOS chips are used. Consult 68P81106E64 before starting repair or maintenance procedures.

3. MAINTENANCE

Isolate malfunctions of this power supply following conventional troubleshooting procedures.

Note that the ac input voltages to the power supply are not sinusoidal and, thus, cannot be measured with a standard ac voltmeter. All voltage checks must be made where dc voltages are present.

CAUTION

Turn the power to the station off and allow time for the capacitors to discharge through their bleeder resistors before attempting to replace components or repair this power supply.

4. FILAMENT VOLTAGE ADJUSTMENT

The filament voltage MUST be readjusted whenever the power amplifier tube is replaced. To make the adjustment, two controls are set while monitoring the filament voltage at the output terminals with a voltmeter. Proceed as follows:

Step 1. Turn on the power to the station and make sure that all interlock switches are closed.

Step 2. Set filament voltage control R59 on the filament regulator board to its midpoint position. Allow the power amplifier tube filaments to warm-up and stabilize for a minimum of two minutes.

Step 3. Connect the VOM across the 6.3 volt output terminals. Set R59 to obtain 6.3 volts. Allow voltage to stabilize for one minute. Repeat until voltage stabilizes.

Step 4. With the VOM still connected across the 6.3 volt output, key the transmitter.

Step 5. Set R60 to obtain a 5 volt reading on the VOM.